AN ECONOMETRIC ANALYSIS OF THE EFFECTIVENESS OF COMPENSATION TO RETENTION

THESIS

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Abstract

In July 2001, Lieutenant General Donald L. Peterson, Deputy Chief of Staff, Personnel, United States Air Force, testified before Congress that adverse retention rates were senior leadership's number one concern. Military compensation sustains "defense manpower policies that in turn support the nation's defense strategy." Defense spending must be allocated efficiently to maintain the optimal mix of forces and weapon systems to respond to national security objectives. The President requested $149.9 billion for military pay and healthcare for Fiscal Year 2009, or 29 percent of the total proposed defense budget. When military compensation constitutes nearly one-third of department expenses, its impact on retention of personnel must meet targets.

This thesis estimates the value of military compensation's effect on the probability of retaining Air Force personnel in a cross-sectional analysis. The findings suggest that compensation packages are effective at retaining military members at critical points in their career to develop senior officer and enlisted leaders. Prior research estimated at the aggregate level, but we modeled our data for individual observations to estimate how members prefer to delay civilian earnings until after retirement eligibility. We found that our findings, while interesting, would improve if estimated through a binary probit model in time-series analysis.

I dedicate this work to family and friends that sustained me during this difficult endeavor.

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Firstly, I thank my committee for their continued support throughout this research effort. I'm thankful to Lt Col Unger and Lt Col Kee for serving both in academic and advisory capacities in addition to being mentors that I will not soon forget.

I thank my family for their patience and understanding during the last few months of my AFIT experience. Their prayers, love, and support sustain my spirits. I look forward to seeing my parents, my brother, and my sister when I return to the proud state of Texas. I have missed them all terribly.

Juan Jose Guzman

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AN ECONOMETRIC ANALYSIS OF THE EFFECTIVENESS
OF COMPENSATION TO RETENTION

I. Introduction

Purpose

This thesis estimates the value of military compensation's effect on the probability of retaining Air Force personnel in a cross-sectional analysis. The findings suggest that compensation packages are effective at retaining military members at critical points in their career to develop senior officer and enlisted leaders. Prior research estimated at the aggregate level, but we modeled our data for individual observations to estimate how members prefer to delay civilian earnings until after retirement eligibility. We found that our findings, while interesting, would improve if estimated through a binary probit model in time-series analysis.

Background

In July 2001, Lieutenant General Donald L. Peterson, Deputy Chief of Staff, Personnel, United States Air Force, testified before Congress that adverse retention rates were senior leadership's number one concern. He went on to say, "We need to attract America's best and brightest, and we must retain them. While patriotism is the number one reason our people – both officers and enlisted – stay in the Air Force, patriotism alone cannot be the sole motivation for a military career" (Peterson, 2001:4). "While intangible factors like patriotism are important draws for many who volunteer to serve,

the military relies heavily on good pay and benefits—the tangible rewards for service—to maintain its competitive edge as an employer in U.S. labor markets" (Williams, 2005:11).

Defense spending must be allocated efficiently to maintain the optimal mix of forces and weapon systems to respond to national security objectives. Compensation to military members of the US armed services is the third largest element of the Department of Defense (DoD) budget, behind Strategic Modernization and Operations, Readiness and Support. The President requested $149.9 billion for military pay and healthcare in Fiscal Year (FY) 2009, or 29 percent of the total proposed budget (DoD, 2008a:6). Historically comparing, the President requested 25 percent more for military compensation than in the previous fiscal year (DoD, 2008a:8).

The nation's military remains engaged in combat, costly both in lives and federal spending, since the 9/11 attacks. From 2001 through the end of FY 2007, Congress spent $602 billion in military operations and related activities in the Global War on Terror (Orszag, 2007:3). As of 18 December 2008, 4,824 military members lost their lives in the wars fought in Iraq and Afghanistan (OSD, 2008). As the complexity of the war grows, military members are challenged with responsibilities in hostile environments that may shape their decision criteria for separating from the service (Burrell, 2007:24). Competitive wages from the private industry may have adverse effects on retention rates of high-quality military members when similar or higher salaries are available without the dangers and instability of war. Military compensation supports "defense manpower policies that in turn support the nation's defense strategy" (DoD, 2008b:33). When military compensation constitutes nearly a third of the entire defense budget, its influence on retention of uniformed personnel must meet targets.

Research Question

How does the marginal effect of cash and non-cash military compensation influence the decision of US Air Force personnel to continue active duty service to retirement eligibility?

Scope

The Sixth Edition of the Military Compensation Background Papers published by the Office of the Secretary of Defense (OSD) identified six principles to guide the discussion on the military personnel compensation system. OSD defined these principles: (1) Manpower/Compensation Interrelationship, (2) Compatibility with Technology and Tactics, (3) Equity, (4) Effectiveness in Peace and War, (5) Flexibility, and (6) Motivational Aspects (OSD, 2005:4).

The first principle recognizes the role of compensation in maintaining the optimal mix of forces in the armed services given their objectives. Compensation must be adequate enough to support manpower policies designed to sustain the military strategies in defense of this nation.

Secondly, compensation must maintain the personnel base, both in rank and skill-set, to meet the manning needs of these weapon systems in the future (OSD, 2005:5). If compensation fails to recruit and retain high quality personnel, the personnel budget will ineffectively crowd-out recapitalization and modernization of weapon systems.

Next, the two basic tenets of equity deal largely with the concept of fairness. Military members, just as any member of the labor force, desire to be compensated fairly; compensation should be comparable and competitive.

Additionally, military compensation must demonstrate effectiveness in the

recruiting and retention of high-quality military personnel in times of war just as in times of peace. DoD only has one compensation system regardless if the armed services are engaged in a military contingency or not, however severe the conflict may be. The department, however, does make minor adjustments to the compensation system to offer monetary benefits when a service member is deployed in support of a military contingency.

Furthermore, military compensation must be flexible to accommodate changes in military objectives and the dynamics of the private sector. Military compensation must be flexible to respond to manpower policies and changes in civilian wages for various sectors.

Lastly, the compensation system must recognize the relationship with pay and effort. The military force structure promotes officers and enlisted members to encourage performance and desire for more responsibility (OSD, 2005:9).

Approach/Methodology

We engaged our research question with a review of previous literature, data collection, and regression analysis to estimate the relationship between military compensation and the retention of uniformed personnel in the US Air Force. We collected data to develop a binomial response variable to quantitatively describe the continuation decision of military members. In our research, we reviewed a series of inputs that we believe have a relationship with the decision military members make regarding retention and collected data to represent these variables. Additionally, we controlled for differences in groups through the use of dummy variables for gender, rank,

Air Force Specialty Code (AFSC), commissioning source for officers, and citizenship status for enlisted members.

We modeled our data at three points available in our sampling frame: the stay-or-go decision from 2001 to 2002, 2004 to 2005, and 2007 to 2008. We estimated officers and enlisted personnel separately through a probit model for binary response. Each model estimated the significant contributing factors in an individual's decision to remain in the service from year *n* to year *n* + 1.

Significance

Researchers often conduct regression analysis using continuous values to describe the dependent variable. Observing the dependent variable on this scale allows it to take on predicted values without restriction. The predicted value of the dependent variable may be expressed as an integer, as a decimal point, and even a negative number when regressed on the explanatory variables. While useful in other conditions, conventional Ordinary Least Squares (OLS) analysis does not reveal the interesting relationship we are concerned with in this thesis because its use constitutes a misspecification.

We modeled the relationship of variables that influence the decision to either remain in active duty service (stay) or pursue employment elsewhere (go). We define this decision as the dependent variable "Continue." The explained variable does not take on continuous values; it is either "Stay" or "Go," or binary in nature. Therefore, we model our independent variables to observe what factors are statistically significant in the individual decision analysis to continue on active duty service in the Air Force from year *n* to year *n + 1*.

Previous research modeled this relationship at the aggregate level. Burrell (2007) used continuation rates to proxy for retention. Continuation rates represent the percentage of Air personnel that continue in active duty service from one year to the next. Burrell's methodology observed how Air Force-level retention changes when factors such as military retirement, unemployment rates, and annual pay raises change. We model our data at the individual level. Researchers may use binary variables to describe a qualitative event; such as dummy variables in the explanatory variables to allow for an intercept change and/or a slope change amongst various groups. Instead, we use a binary variable to describe a qualitative event: will an individual stay in the Air Force ($y = 1$) or go ($y = 0$) with a given value of x_n?

II. Literature Review

Overview

In July 2001, Lieutenant General Donald L. Peterson, Deputy Chief of Staff, Personnel, United States Air Force, testified before Congress that adverse retention rates were senior leadership's number one concern. He went on to say, "We need to attract America's best and brightest, and we must retain them. While patriotism is the number one reason our people – both officers and enlisted – stay in the Air Force, patriotism alone cannot be the sole motivation for a military career" (Peterson, 2001:4). "While intangible factors like patriotism are important draws for many who volunteer to serve, the military relies heavily on good pay and benefits—the tangible rewards for service—to maintain its competitive edge as an employer in U.S. labor markets" (Williams, 2005:11).

Military Compensation Context

The Sixth Edition of the Military Compensation Background Papers published by the Office of the Secretary of Defense (OSD) identified six principles to guide the discussion on the military personnel compensation system. OSD defined these principles: (1) Manpower/Compensation Interrelationship, (2) Compatibility with Technology and Tactics, (3) Equity, (4) Effectiveness in Peace and War, (5) Flexibility, and (6) Motivational Aspects (OSD, 2005:4).

Manpower/Compensation Interrelationship

The first principle recognizes the role of compensation in maintaining the optimal mix of forces in the armed services given their objectives. Compensation must be adequate enough to support manpower policies designed to sustain the military strategies

in defense of this nation. Force shaping problems, an imbalance of officers and enlisted personnel or among specialties and skills, will likely ensue when compensation does not adequately meet service member expectations. Lieutenant General Roger A. Brady, former deputy chief of staff for manpower and personnel, stated, "If we get too far out of balance, we cannot operate as effectively. We cannot recapitalize, we cannot replace the old equipment that we have. And the Airmen who remain with us do not get the training they need or the equipment they need, and we have hard time sustaining operations" (Gettle, 2006a). Those results will frustrate national security strategy and, in turn, negate defense policy objectives (OSD, 2005:4).

Compatibility with Technology and Tactics

The emergence of costly technologies on the battlefield to support military tactics heightens the level of scrutiny on military compensation. Firstly, compensation places a tremendous fiscal burden on the Defense budget; the costs must not encumber on the procurement for new weapon system requirements. In recent years, the Air Force's efforts to recapitalize and modernize aging weapon systems led to a reshaping of force structure. The Air Force targeted 20,000 reductions in military personnel between fiscal years 2005 and 2007; this included 8,000 personnel cuts in the officer corps in 2007 alone (Gettle, 2006a,b). The military reductions coincided with the most fleet modernization funding requested in 15 years as the Air Force made large investments in C-17 Globemasters, F-22A Raptors, and unmanned aerial vehicles (Munoz, 2006). Compensation must maintain the personnel base, both in rank and skill-set, to meet the manning needs of these weapon systems in the future (OSD, 2005:5). If compensation fails to recruit and retain high quality personnel, the personnel budget will ineffectively

crowd-out recapitalization and modernization of weapon systems.

Equity

The two basic tenets of equity deal largely with the concept of fairness. Military members, just as any member of the labor force, desire to be compensated fairly; compensation should be comparable and competitive. Comparable refers to uniformed personnel being paid what one would expect in the private sector. DoD programs compensation based on civilian positions with similar responsibilities and possessing similar experience and education levels. The concept of competitiveness relates how well military compensation compares to private sector salaries. In order to compete for high-quality uniformed personnel, members must prefer military compensation to private industry compensation (OSD, 2005:5). The degree to which military members prefer military compensation measures how well competitive pay and benefits met the military members' expectations. We expect military members to value the comparability and competiveness of military compensation differently based on the years of service because the value of deferred benefits become more valuable as a military member gets closer to retirement eligibility.

Effectiveness in Peace and War

Military compensation must demonstrate effectiveness in the recruiting and retention of high-quality military personnel in times of war just as in times of peace. DoD only has one compensation system regardless if the armed services are engaged in a military contingency or not, however severe the conflict may be. The department, however, does make minor adjustments to the compensation system to offer monetary benefits when a service member is deployed in support of a military contingency. The

benefits include, but are not limited to, exclusion from federal income tax, family separation allowance, and hardship duty pay for the months that a member serves in a deployed location. OSD designs the compensation system to allow normal flow of personnel to complement barriers to entry and exit of the service, in the recruiting of high-quality personnel and separation or retirement of military members, respectively. The effectiveness of the compensation system in sustaining the best mix of forces allows mission success during peacetime training and wartime execution (OSD, 2005:7).

Flexibility

Despite the use of only one compensation system, military compensation must be flexible to accommodate changes in military objectives and the dynamics of the private sector. Compensation must be economically efficient, as General Peterson said, in keeping "…the right number of people. Not too few. Not too many" (Gettle, 2006a). He added, "I think there are a lot of things we find, when you have a large organization like the Air Force, that are inefficiencies we can cut out. We are going to be more efficient than we have been forced to in the past." Changes in the national economy and the supply and demand of high-quality personnel motivate rapid adjustments in compensation (OSD, 2005:8). For example, wage increases in private industry have changed across time; however, compensation within and across white- and blue-collar industries has not followed the same pattern (Schwenk, 1997:14). Differences in skill, education, and ability help explain how the range of salaries has grown since the early 1980's (Asch, 2002:2). To accommodate such dynamics, the Air Force offers special pays to retain specialty skills. For that reason, competitive bonuses are offered for professionals in the aviation, legal, and medical fields to retain against changes in civilian

wages for the same sectors.

Motivational Aspects

Lastly, the compensation system must recognize the relationship with pay and effort. The military force structure promotes officers and enlisted members to encourage performance and desire for more responsibility (OSD, 2005:9). "A promotion is not a reward for past service; it is an advancement to a higher grade based on future potential as demonstrated by past performance" (AFI 36-201, 2007:62). Duty positions are designed to commensurate with the level of responsibility for the appropriate rank. The Air Force awards promotions based on relative rather than absolute performance. Greater potential may be associated aptly with smarter or more capable personnel since these individuals are more likely to achieve a higher rank-order. However, less able military personnel can overcome the disadvantage by exerting more effort. Therefore, the compensation system should motivate personnel to perform at or even beyond their potential as measured by intelligence (Asch, 1994:54).

Assessment of Military Compensation

Active duty military personnel earn compensation commensurate with rank, years of service, and dependency status. 10 U.S.C. §101(d)(1) defines active duty personnel as those members on full-time duty in the active service to include full-time training, annual training duty, and attendance, while in the active military service, at a school designated as a service school by law, or the Service concerned. DoD does not consider full-time National Guard duty as active-duty despite the similarities. The department, since the Gorham Commission in 1962, assesses active-duty personnel pay relative to private industry wages through the use of Regular Military Compensation (RMC) (OSD,

2005:14). Four elements comprise RMC that military members receive either directly or indirectly, in cash or in kind: basic pay, basic allowance for housing, basic allowance for subsistence, and tax advantage.

Grade and years-of-service determine the first component, basic pay. Most often, rank and grade are parallel. For example, a Captain earns O-3 pay and a Master Sergeant earns E-7 pay. When a member fills a duty position that requires an individual with a higher rank, the member can be frocked. In that event, the member wears a higher rank, but continues to be paid according to their current grade. The Defense Finance and Accounting Service (DFAS) publishes basic pay rates annually; the rates include pay raises as years-of-service and grade increase. Secondly, military members earn Basic Allowance for Housing (BAH), a non-taxable housing allowance based on rank and dependency status and adjusted for duty location, to defer housing costs at the members' duty location. The Per Diem, Travel, and Transportation established BAH rates to prevent military members from incurring out-of-pocket expenses beyond the entitlement for a rental property. The expected square footage for a member at a particular grade and dependency status determines the dollar value of the entitlement. Next, Basic Allowance for Subsistence (BAS), a non-taxable allowance as well, serves to defray the cost of food for military members; the amount is based on whether the member is an officer or an enlisted Airman. BAS, unlike the other entitlements, pays a lower rate to officers than to enlisted members. Lastly, federal income tax advantage rounds out the four elements of RMC. Since BAS and BAS are not taxed as income, OSD quantifies the tax advantage as the dollar value that a member would pay in federal income tax if they were taxed. (DoD, 2008b:20)

History

History shows that since the beginning of the all-volunteer force, retention suffers when RMC falls with respect to civilian wages. Military officials attribute this pay gap to the recruiting problem that beset the military services in the late 1970's. The DoD Authorization Act of 1981 included an 11.7 percent pay increase to mitigate the recruiting and retention shortfalls when RMC was set to civilian wages for workers with comparable education and experience levels (OSD, 2005:34). Many pay comparisons begin in 1982 since Congress instituted large raises to mitigate perceived pay gaps between military personnel and workers in the private sector (CBO, 2007:2).

The Quadrennial Review of Military Compensation (QRMC) is an investigative look at compensation charged to the Secretary of Defense by the President. In his charge to the Secretary for the 10th QRMC, President George W. Bush stated in August 2005:

> To continue to recruit and retain highly qualified personnel for the uniformed services as they transform themselves to meet new challenges, the departments concerned must offer, in addition to challenging and rewarding duties, compensation appropriate to the services rendered to the Nation. The departments also must apply the substantial taxpayer resources devoted to uniformed services compensation in the most effective manner possible (DoD, 2008b:ix).

For more than 30 years, the DoD successfully recruited and retained personnel in the correct size and skill-set to support the Department's strategy objectives. The DoD recruited 180,000 new active duty enlisted members in fiscal year 2007; not one branch of service failed to meet its recruiting goals. This number may suggest that there is not a recruiting problem, however there are more details worthy of note.

The DoD evaluates the quality of enlisted recruits through the use of two measures called educational achievement and training aptitude. Educational achievement is the

percentage of recruits who successfully complete high school. The DoD uses the Armed Forces Qualification Test (AFQT) as the training aptitude measure.

Recruits with high school diplomas and scores at the 50th percentile or higher generally complete their first term of enlistment and perform better on the job than those with General Educational Development certificates and scores below the 50th percentile. The DoD sets the educational achievement standard at 90 percent of recruits completing high school. The training aptitude benchmark is 60 percent scoring at or above the 50th percentile, or Category I-IIIA.

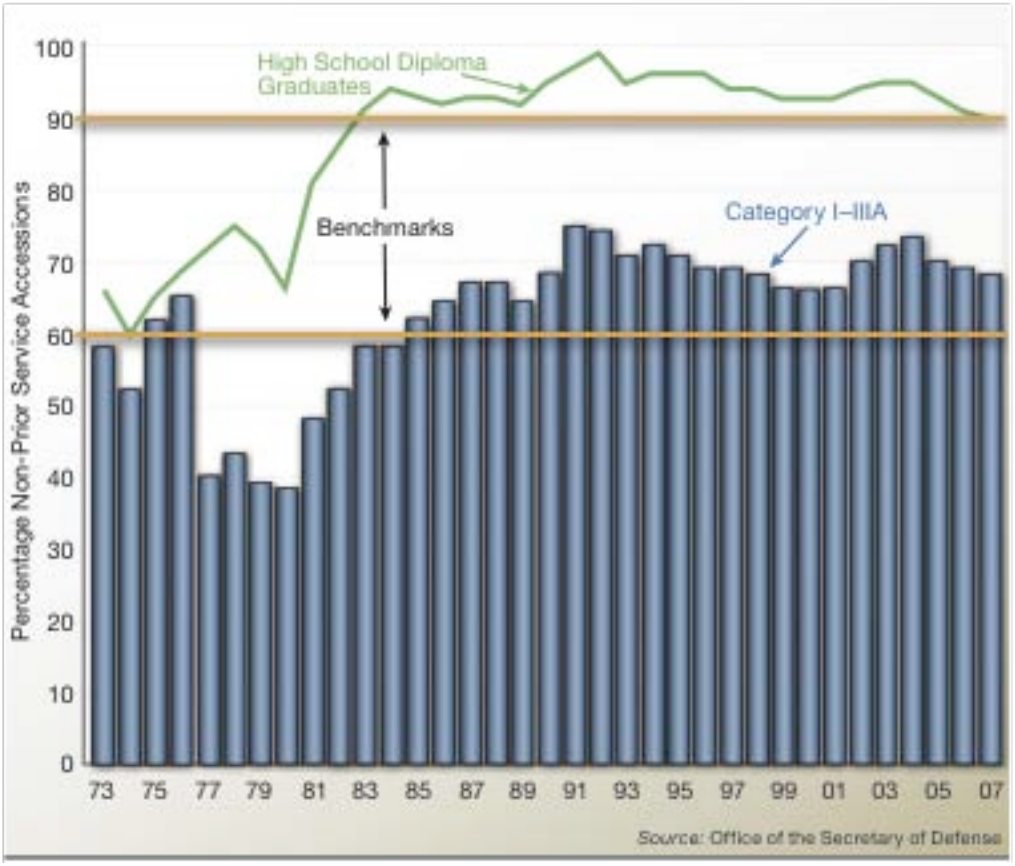

Figure 1. Recruit Quality for the Active Duty Enlisted Force, 1973-2007

Source: (DoD, 2008b:4)

Figure 1 suggests that while raw numbers are being met for the size of recruiting classes

in the DoD, the proportion of accessions that the Department targets as high-quality recruits has fallen consistently in the past fifteen years aside from an increase following the boost in patriotism in the United States following the 9/11 attacks.

Figure 2 aggregates the two measures of recruit quality but separates the success of recruiting between the branches of service. The reader should note that the proportion of high quality recruits decreased as the number of authorizations in the DoD were drawn down throughout the 1990's. This left fewer high-quality uniformed personnel to fill the senior ranks in subsequent years and may leave a void in the capabilities of tomorrow's force.

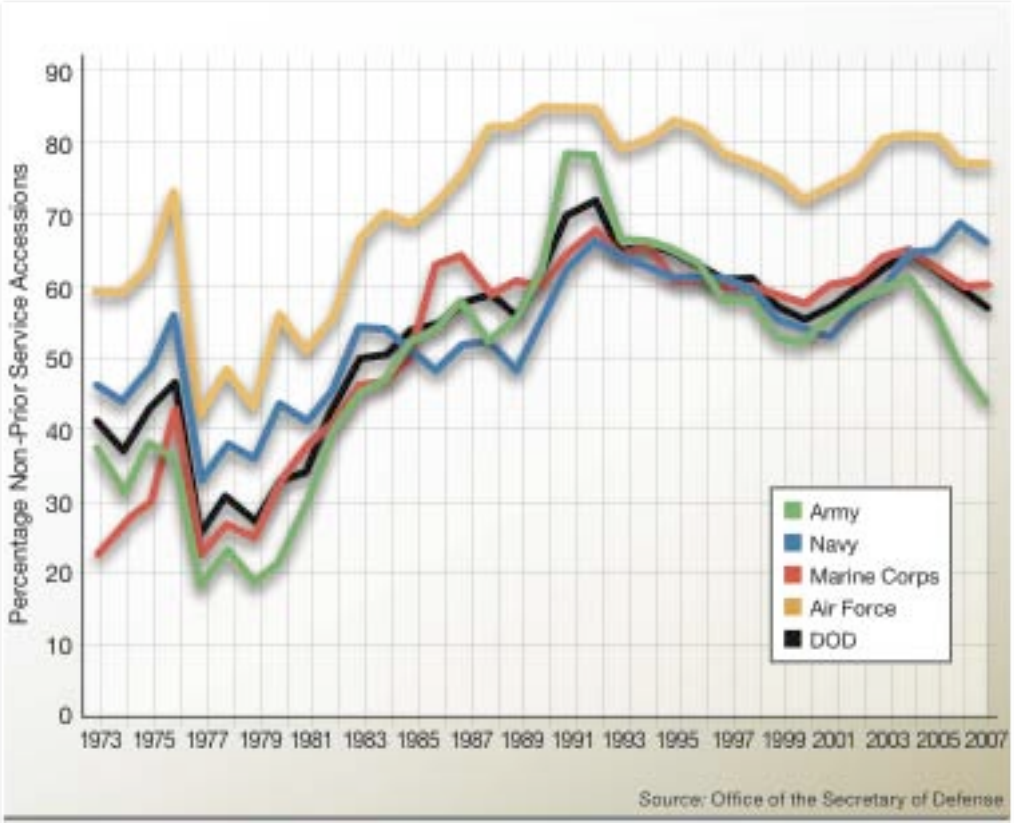

Figure 2: High-Quality Recruits to the Active Duty Enlisted Force, 1973-2007

Source: (DoD, 2008b:5)

In Figure 2, we observe a downward trend in recent years. After a brief increase in the quantity of high-quality recruits in 2000, we see a downward trend re-emerge in 2004. Drops in the proportion of high quality recruits can be attributed to a few external factors: more students entering two- and four-year colleges and universities, increase in family income to pay for students entering higher learning institutions, a growing economy, and less influencers recommending the military.

How do these recruiting talking points affect retention? The decreasing number of high-quality recruits leaves a smaller pool of talent to fill senior ranks. The 9th QRMC recommended that military pay be comparable to the 70th percentile of civilian wages of similar education and experience. In previous years, the DoD used high school graduates as the appropriate demographic to program salaries of enlisted personnel and college graduates for officers. The 2002 analysis found that education levels of the mid- and senior-level enlisted ranks and junior officers have increased significantly in recent years. A 2005 study estimated that 72 percent of enlisted members had one or more years of college education. (CBO, 2007:12). Therefore, the 9th QRMC found RMC to be below the 70th percentile of these groups when compared to the targeted civilian populations. The 2002 National Defense Authorization Act included a pay increase to retain and draw down the pay gap between mid- and senior level non-commissioned officers (NCOs) and junior officers with civilian wages. We observed, as a result, more favorable comparison between military and civilian wages. For example, in 2006 the average enlisted member earned approximately $5,400 more than civilian counterparts; the average officer earned $6,000 more. The following figures compare RMC to the 70th percentile for enlisted and officer personnel, respectively, in 2006. The graphic confirms a 2005 analysis that

suggested RMC is comparable to the selected benchmark. (CBO, 2007:2).

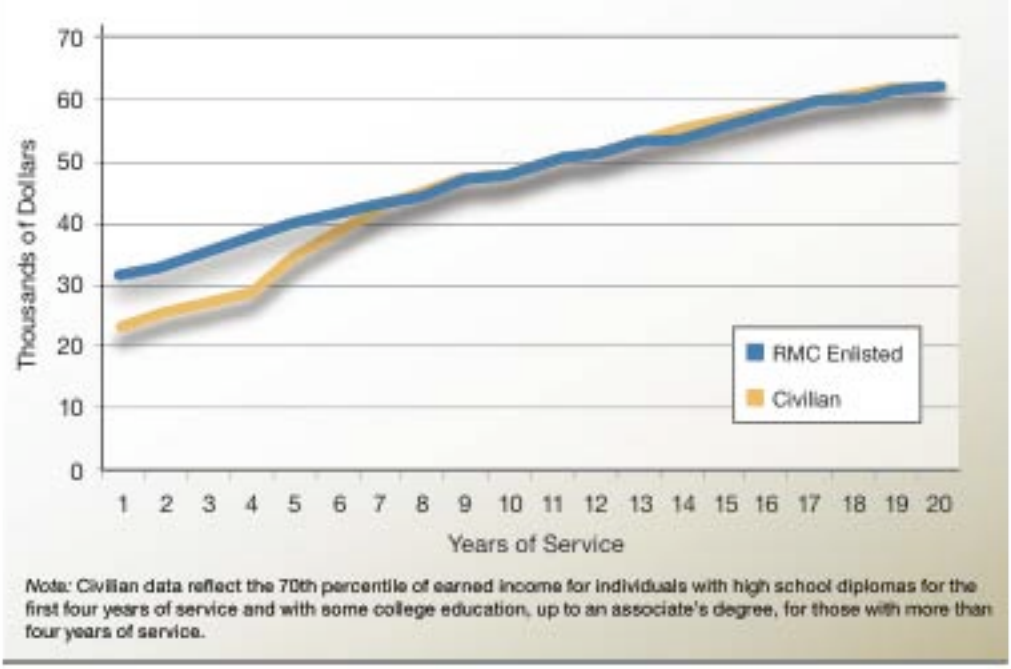

Figure 3: Enlisted Regular Military Compensation versus Civilian Earnings, 2006

Source: (DoD, 2008b:25).

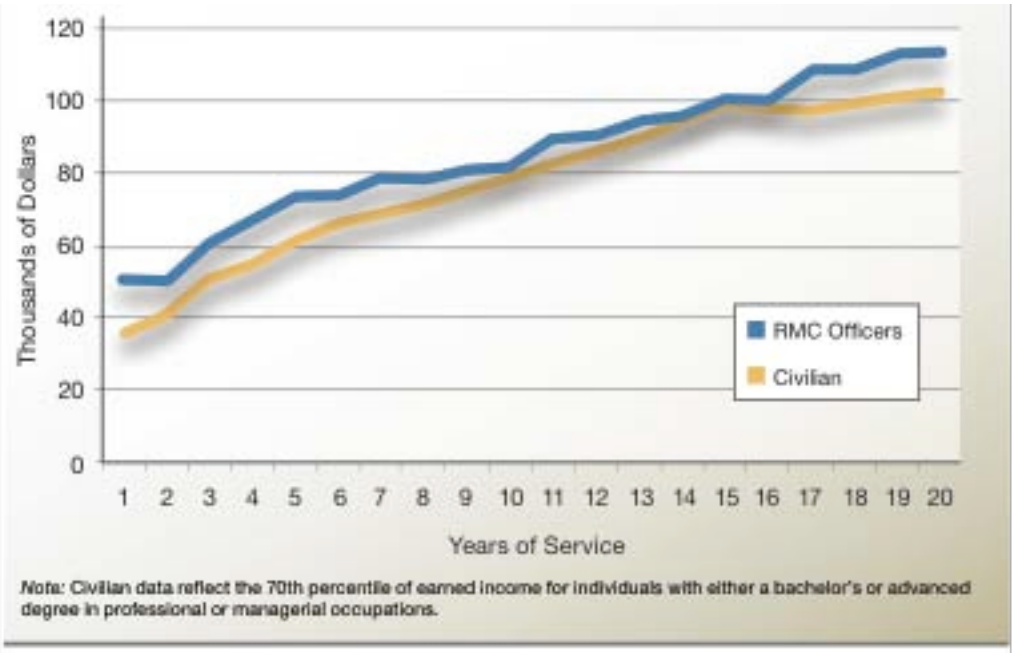

Figure 4: Officer Regular Military Compensation versus Civilian Earnings, 2006

Source: (DoD, 2008b:25).

Although interesting for a quick, aggregate review of the average military member, the decision criteria of military members is anything but average. For example, the top 50 percent of officers work in thirteen of a possible 141 fields. How do those officers compare to wage earners in the civilian population? Does the civilian population have 50 percent of its work force working as mobility pilots, fighter pilots, clinical nurses, air battle managers, development engineers, students, or employed in communications and information, space and missile, intelligence, personnel, and logistics readiness? While the answer to that question is outside of the scope of research for our paper, we introduce the idea because we believe that military members are too complex to model at the aggregate level. The military member perceives skill transferability, education benefits, the economy, and the value of cash and non-cash compensation differently and should be modeled at the individual level.

Types of Compensation

Cash compensation, or RMC, composes 48 percent of total compensation to uniformed personnel and is usually the source of basis between comparable wages between military members and private industry. There are four elements that make up RMC: basic pay, BAH, BAS, and the tax advantage incurred because BAH and BAS are not taxed as income.

Basic pay, the largest part of RMC at approximately 58 percent, is paid to all uniformed personnel based on rank and years of service except during periods of unauthorized absence, excess leave, or confinement after an enlistment has expired. It is annually adjusted to reflect increases in civilian sector wages and inflation. Civilian

sector wages are estimated using the Economic Cost Index (ECI) found in the Labor Statistics published by the Bureau of Labor Statistics. By law, the annual increase in basic pay should be equal to ECI, but Congress approves increases in the National Defense Appropriations Act above and beyond ECI when military compensation levels are an area of concern.

Military members residing in civilian quarters are paid BAH, a tax-exempt housing allowance. The DoD reviews and annually adjusts BAH as the amount needed to rent adequate housing at military members' duty location. (OSD, 2005:19). Military members can anticipate adequate housing to be the square footage needed based on expected family size at particular ranks. The dollar value of the entitlement varies according to rental costs at the member's duty location and a higher rate is paid to personnel with dependents; on average, BAH comprises nearly 18 percent of cash compensation. On average, single members receive 23 percent less BAH than their cohorts with dependents.

Military members are paid BAS, a tax-free payment, to be partly defray the cost of feeding the member; there are no provisions for military dependents. The annual adjustment for BAS is uniquely tied to the change in the price of food, not wages (OSD, 2005:183). Again, unlike BAH, the payment does not increase as rank does. Instead, one rate is paid to enlisted members and one rate is paid to officers with the former being higher than the latter. In 2007, enlisted members were paid $279.88 per month; officers were paid $192.74. On average, these disbursements constitute 7.2 percent of enlisted RMC and 2.6 percent of officer RMC.

Lastly, the federal income tax advantage is based on an individual member's tax

bracket, number of exemptions, student status, retirement contributions, deployment status, and a series of other factors that may impact adjust gross income. The tax advantage is estimated to constitute 6.1 percent of RMC on average if BAH and BAS were taxed as regular income; however, the number varies greatly based on the member's tax situation.

Non-cash Benefits

Non-cash benefits, some of which that were considered in the MAC estimated by the 10th QRMC, compose 21 percent of compensation to the average military member. Healthcare and government housing are the two largest portions of non-cash benefits.

Healthcare expenses are difficult to quantify since military members do not pay insurance premiums. Instead, the DoD provides healthcare to uniformed personnel and their dependents free of charge through military treatment facilities. When care at military treatment facilities is not possible, either in general or for the particular type of care needed, a network of healthcare providers is available for those patients. Another large component of non-cash benefits is government quarters.

In 2006, 43 percent of uniformed personnel resided in military housing. A member either receives BAH payments or resides in government quarters while assigned at a permanent duty location. Similar to BAH, the value of government quarters varies greatly based on rank and number of dependents, and in limited instances, to position or duty title. Many of the members who reside in government quarters are single junior-ranked enlisted members in dormitory or barracks-styled housing. Housing managers typically assign members with dependents to townhouses, duplexes, and single-family homes when residing in government quarters.

Deferred Benefits

Lastly, the DoD pays 31 percent of compensation to military members through a series of deferred payments and benefits available upon retirement after 20 years. The military retirement program is similar to most defined benefit plans in that DoD calculates payments based upon on a formula (Savych, 2005:23). Under the current system, the retirement pay is 2.5 percent of the member's average of his or her "High-3" years of basic pay multiplied by number of years of service. For example, a member retiring after 20 years of service would be paid 50 percent (2.5% x 20) of their High-3 years of basic pay. DoD estimates that less than 15 percent of enlisted members and 47 percent of officers will remain in service long enough to retire from the military. We perceive these percentages as significant when considering healthcare costs. Funding set aside in 2006 for future healthcare liabilities totaled $13 billion, or approximately 87 percent of the cost for active duty healthcare in the same year (DoD, 2008b:23). The DoD programs nearly as much resources for future healthcare liabilities of retirees as it does for active duty personnel.

Military compensation comes in many forms; however, DoD only uses basic pay in calculating the retirement annuity. The Office of the Actuary found that while a 20-year retiree may be entitled to 50 percent of basic pay, the retiree only receives 34 percent of RMC. Likewise, a 30-year retiree will receive 75 percent of basic pay but only 54 percent of RMC (Actuary, 2007:10).

The current retirement system available to eligible uniformed personnel is a defined benefit plan. Employee retirement plans may otherwise be defined contributions plan. The Department of Labor identifies a defined contribution plan as "a type of retirement

plan in which the amount of the employer's annual contribution is specified. Individual accounts are set up for participants, and benefits are based on the amounts credited to the accounts, plus any investment earnings on the money in the account." In 2006, 90 percent of medium to large private employers provided some form of retirement plan, but less than 40 percent offered a defined benefits plan (CBO, 2007:25).

For employees that do not plan to retire from the armed forces or desire to supplement the military defined benefits plan upon retirement, the Thrift Savings Plan (TSP) is available to them. The TSP offering may be perceived as an acknowledgement of the inadequacy of the defined benefits retirement plan as a retention tool for targeted military personnel. The TSP is very similar to the 401(k), the most common defined contributions plan offered to civilian workers. It offers five investment mutual funds: Government Securities Investment Fund (G), the Fixed Income Index Investment Fund (F), the Common Stock Index Investment Fund (C), the Small Capitalization Stock Index Investment Fund (S), and the International Stock Index Investment Fund (I). We introduce the concept TSP because it may serve as an enabler of separation. Whereas previously military members had an all-or-nothing retirement benefit available through their employer, members now have a broad market investment tool that fully vests investors before twenty years of service.

The vesting period differs greatly between the private sector and the armed services. Most vesting rules for private-sector retirement plans are set out in the Employee Retirement Income Security Act of 1974. Employees in the civilian sector are required to be fully vested after 7 years by federal law, but the funds are not available for withdrawal without penalty until 59 ½ years of age (OSD, 2005:939). Employees are

entitled to their own contributions immediately; vesting rules govern when they are entitled to employers' contributions (CBO, 2007:16). Additionally, 401(k) withdrawals receive no protection against the effects of inflation unless a portion of the investments is made in tax-exempt government bonds. The military retirement annuity is not available to personnel until they reach 20 years of service. While the vesting period may differ by 13 years, military retirement is valuable since it pays immediately following retirement. This can be as early as 38 years of age for enlisted personnel and 42 for officers. In contrast to 401(k) withdrawals, the DoD protects the military retirement annuity against inflation by annually adjusting the payment.

Warner and Pleeter (2001), in research that reviewed how military members preferred lump sum payments to a deferred annuity, estimated that military members' personal discount rate ranged from zero to 30 percent. The work added that the vast majority of military members personal discount rates exceed 18 percent. Since defined contribution plans vest after a few years and nearly immediately become part of the employee's investment portfolio, and because junior military members highly discount retirement benefits, civilian retirement programs are more valuable than the military retirement annuity in early years of uniformed personnel careers. The value of military pension increases as military members approach 20 years of service because the probability of becoming eligible for military retirement increases. The uncertainties regarding whether a member will become retirement eligible, or how long the member will live, may affect member personal discount rates. The figures below provide a graphical depiction of the 10th QRMC's representation of MAC to include the value of military retirement throughout a 20-year career of enlisted personnel and officers (DoD,

2008b:33).

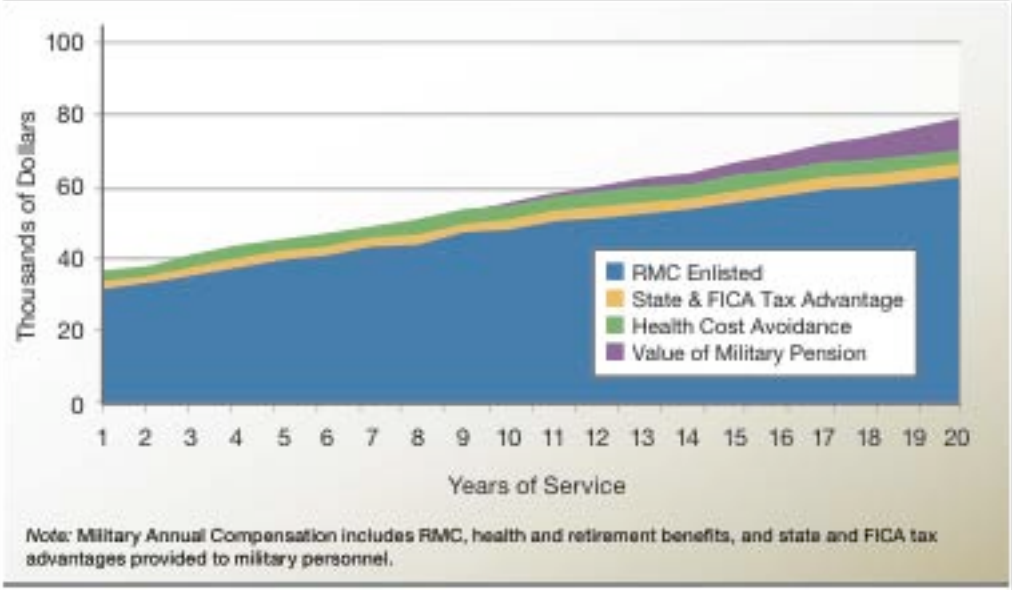

Figure 5: Military Annual Compensation for Enlisted Personnel, 2006

Source: (DoD, 2008b:33)

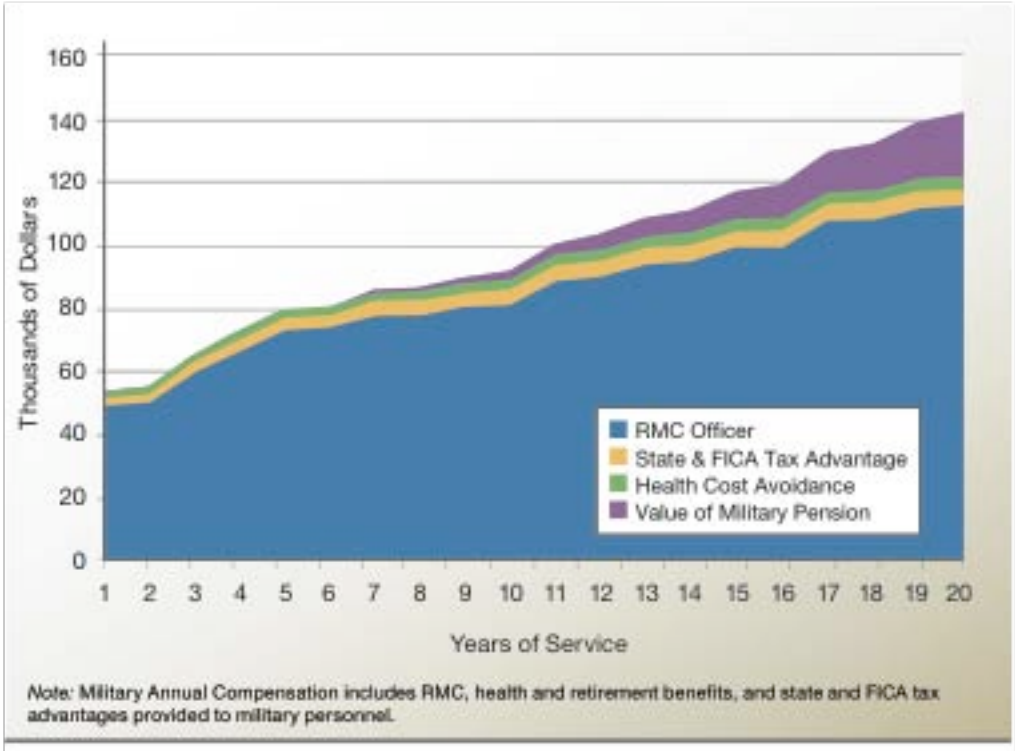

Figure 6: Military Annual Compensation for Officers, 2006

Source: (DoD, 2008b:33)

Burrell (2007) attempted to capture the value of military retirement through present value analysis of the pay gap between the military and civilian sectors. The author used cumulative pay gap to represent the future value of an annuity due, but the dollar value was not high enough to solve the rate of return equation, suggesting an infinite return.

The DoD annually adjusts non-disability retirement for inflation with Cost-of-living adjustments (COLA) every December 1st to be reflected in basic pay the following calendar year. The increase is calculated by the average percentage increase in the Urban Wage Earner and Clerical Worker Consumer Price Index from the third quarter of the previous year to the third quarter of the current year (Actuary, 2007:9). Additionally, COLA and retirement pay do not reduce social security benefits. Since military

personnel have paid social security taxes, they are entitled to full benefits in addition to their military retirement annuity (Henning, 2006:4).

Retirement Debate

Why does military retirement continue to be a hot topic? Critics of non-disability retirement contest that military retirement (1) retains too many average or below-average performers on active duty, (2) does not encourage enough members to remain beyond 20 years of service, and (3) fully vests too late at the 20-year mark. Critics also suggest that compensation policies inherited from 1940's legislation are largely outdated (Williams, 2005:12). Rapidly increasing retiree-related benefits may "crowd out" defense resources that could otherwise be used for manpower objectives and weapon system procurement and sustainment. "The military retirement system has been cut twice since 1980, and since 1993 has been the target of 17 legislative proposals to further reduce the value of military retirement compensation" (Fenton 1999:2). Research suggests that substantial savings, as much as $2.4 billion annually, are possible in the conversion to a defined contribution retirement (Asch, Johnson, and Warner 1998: 48). Another argument rebuts that with an annual $450 billion defense budget, retiree benefits are not significant enough to "crowd out" defense capabilities, and that a $12-trillion Gross Domestic Product (GDP) can adequately fund both military retirement benefits and present national security objectives.

There are approximately 2.1 million military retirees and survivor benefit recipients. This population and their associations' efforts to secure more retiree benefits is supported by four dynamics:

(1) the outpouring of nationwide nostalgia and support for the past heroism and

> current old-age needs of the "greatest generation" of World War II-era veterans; (2) concern over problems the military services were having in recruiting and retaining sufficient numbers of qualified personnel, which have been exacerbated by ongoing military operations in Iraq and Afghanistan, and to the extent to which actual or perceived inadequacies in retirement benefits may have been contributing to these problems; (3) the impression by many current of former military personnel that the Clinton Administration was not favorably disposed toward the military as an institution, leading to efforts to portray increased retirement benefits as a palliative, and (4) in a reversal of the attitudes toward the Clinton Administration, efforts to obtain more benefits from the Bush Administration because it is perceived as being pro-military. And since September 11, 2001, there has been a predictably dramatic increase in public and congressional support for the Armed Forces (Henning, 2006:1).

The cost of the military retirement pension is budgeted through accrual accounting. The DoD budget for each fiscal year includes an estimation of dollars plus interest accrued in U.S. government securities needed to fund future military retirement annuities. The budget outlays are transferred to the Military Retirement Fund (MRF), located in the Income Security Function of the federal budget. Approximately 35 to 40 percent of military basic pay costs are programmed in the annual DoD personnel budget for transfer to the MRF. The interest it earns funds retiree pay for current active duty personnel in the current fiscal year that will become eligible for retirement (Henning, 2006:2).

Since there is a slow increase in the number of retirees and survivor benefits recipients, coupled with inflation, the cost of military retirement rises each year. The table below indicates the costs of payments to current retirees (federal budget outlays) and funds set aside for future retirees (accrual outlays) (Henning, 2006:8).

Table 1: Military Retirement Outlays (billions of current dollars)

Table 2. Military Retirement Outlays
(billions of current dollars)

	Total federal budget outlays	Accrual outlays from DOD budget
Estimated FY2006*	$40.9	$13.1
Estimated FY2005*	39.1	15.1
Actual FY2004*	37.2	14.1
Actual FY2003**	35.6	13.7
Actual FY2002**	35.1	12.9

* *FY2006 Budget of the United States Government*. Appendix, pp. 953-954.
***FY2005 Budget of the United States Government*. Appendix, p. 927.

Source: (Henning, 2006:8)

The defense budget requirements for military retirement are costly, and under current trends, will continue to climb. As explained earlier, the primary purpose of military compensation is to support defense manpower objectives and ultimately the national security strategy of the United States. Burrell (2007) found through panel regression that the retirement system, a major component of compensation to uniformed personnel, does influence a member's decision to remain in the military or seek alternative employment. In that study, enlisted members and officers were modeled separately to estimate the relationships with retention to military retirement, unemployment in the private sector, the existence of military contingencies, and additional pay above and beyond ECI. Burrell stated the greatest potential in the thesis lies in capturing the rate of return of our current retirement system.

Burrell's enlisted model explained the majority of variation (R-squared 0.992) in continuation rates, the variable used to describe retention. Only two variables were found to be statistically significant, the rate of return of the MRF and whether or not a contingency operation was in effect. He found that as the rate of the retirement plan

increased an individual would have a greater propensity to remain in the military. The model predicted that when a military contingency was in effect, an enlisted member was more likely to remain on active duty. While the variable was statistically significant, very little magnitude was associated with military contingency effects. The author argued that high operations tempo may weigh heavily on enlisted member's minds on remaining in the military, but it is not heavily acted upon.

Burrell did not explain with success the variation in continuation rates among officers that he modeled with enlisted members (R-squared 0.4769). The rate of return of the MRF was found to be significant and to have the greatest magnitude of any variable. However, the coefficient was unexpectedly found to be negative suggesting that an increase in return raises the desire of officers to separate. Burrell provided two possible explanations for this: (1) the rate of return was lower than expected and (2) MRF is not a reliable proxy for military retirement's effect on officer retention. The other statistically significant variable in Burrell's officer model was the unemployment rate. Again, the model provided unexpected results because the coefficient on unemployment is negative. This suggests that when unemployment increases, a suggestion that the economy is suffering, retention among officers deceases. Burrell explained this through the effect of a patriotic calling.

Moon (2004) in an analysis of surveys administered to separating members, found patriotism to rank 36 of 38 variables associated with separating from active duty service. This contests Burrell's claim that military members would enter private industry to "save" the economy in a calling to patriotism. Conducted in 2000, the surveys ranked retirement programs #12, availability of dependent medical care #13, pay and allowances

#17, and availability of medical care #21 among 38 influences to leave active duty service. The top three reasons for leaving the services were availability of comparable civilian jobs, choice of job assignment, and say in base of assignment.

Scheuchner (1996) found that when looking at influencing factors in the separation decision of officers, that availability of civilian jobs, say in the assignment process, geographic stability, family separation, and pay and allowances were all statistically significant. However, the magnitude of pay and allowances were lower than all of the other variables.

In Burrell's models, the author used a dummy variable to indicate whether a contingency variable was in effect or not. This approach may fail to quantify the relationship of retention with the intensity of a given military contingency. Bernal (2006) wrote that studies indicate troops who served in Iraq are suffering from Post-Traumatic Stress Disorder (PTSD) and other problems on a scale not seen since the Vietnam War. According to Walter Reed Medical Center Army Institute of Research, 19 to 21 percent of troops who returned from combat deployments meet criteria for PTSD, depression, or anxiety. Almost 82 percent of medical evacuations during Operation Iraqi Freedom were due to psychiatric reasons as compared to 15 percent estimated during the Vietnam War. The war in Iraq is the nation's bloodiest war since the military ended conscription in favor of an all-volunteer force (Williams, 2005:15). Hosek *et al.* (2006: xvi) found increased operations tempo to be a significant factor on continued service for enlisted personnel. The heavier burden placed on military personnel in contingency operations may weigh heavily on the decision to stay-or-go because of increased operations, the intensity of conflict, and chronic separation from family.

Hoge (2006) found through research that combat duty in Iraq was associated with high utilization of mental health services and attrition from military service after deployments. PTSD was associated with a 60 percent increase of medical utilization by patients for physical problems including respiratory, cardiovascular, neurological, and musculoskeletal disorders.

The next chapter will lay the roadmap for modeling retention of Air Force officers and enlisted members using the value of military retirement, economic factors external to military service, and the intensity of military contingencies.

III. Methodology

Research Question

How does the marginal effect of cash and non-cash military compensation influence the decision of US Air Force personnel to continue active duty service to retirement eligibility?

Overview

We engaged our research question with a review of previous literature, data collection, and regression analysis to estimate the relationship between military compensation and the retention of uniformed personnel in the US Air Force. We collected data to develop a binomial response variable to quantitatively describe the continuation decision of military members. In our research, we reviewed a series of inputs that we believe have a relationship with the decision military members make regarding retention and collected data to represent these variables. Additionally, we controlled for differences in groups through the use of dummy variables for gender, rank, Air Force Specialty Code (AFSC), commissioning source for officers, and citizenship status for enlisted members.

We modeled our data at three points available in our sampling frame: the stay-or-go decision from 2001 to 2002, 2004 to 2005, and 2007 to 2008. We estimated officers and enlisted personnel separately through a probit model for binary response. Each model estimated the significant contributing factors in an individual's decision to remain in the service from year n to year $n + 1$.

Variables

Continuation

The Defense Manpower Data Center (DMDC) provided individual level data on Air Force personnel from the years 2001 to 2008. Technicians at DMDC developed the sampling frame by randomly sampling a cohort from 20 percent of the active duty personnel in 2001. The sampling frame included observations for personnel until 2008 unless a member separated or retired. We used the 2008 observations only for developing the "Continuation" variable for 2007.

We defined the "Continuation" variable as our dependent variable. It is binary in nature with a value of one when a member remains in the active duty Air Force from year *n* to year *n* +1, or zero when the same member separates or retires before year *n* + 1. We developed this variable by observing when a member existed in the cohort in the subsequent year and coding the observation accordingly.

Unemployment Rates

Previous research revealed two interesting characteristics about unemployment rates. Firstly, retention rates tend to be lower when unemployment rates are lower (Asch *et. Al.*, 2002). Secondly, during the time period observed in this study, availability of comparable civilian jobs consistently ranked within the top three of thirty-eight influencing factors for separation from active duty service (Moon, 2004). Additionally, after reviewing the Conference Board Index of Leading Indicators, we expect unemployment rates to be countercyclical, leading indicators of economic health. The relationship infers that when unemployment falls, expansionary business cycles tend to follow. Therefore, we used the unemployment rate to control for variance in the

dependent variable by measuring both availability of comparable jobs and the health of the US economy.

The Department of Defense measures comparability of military compensation to civilian wages based on experience and education (DoD, 2008: 17). We explored the same logic when we developed a proxy for availability of comparable jobs in the private sector. A military member would pursue similar or higher earnings in private sector employment according to experience and education required. Therefore, a military member would measure civilian job availability by an unemployment rate according to education levels. We retrieved the employment status of the civilian noninstitutional population by gender and highest level of education attained from the Bureau of Labor Statistics of the United States Department of Labor.

Value of Cash Compensation

OSD pays cash compensation through four components collectively defined as Regular Military Compensation: basic pay, BAH, BAS, and the tax advantage incurred because BAH and BAS are not taxed as income. We principally concerned ourselves with basic pay for three reasons: (1) BAS only varied whether the member was enlisted or an officer; (2) BAH differed according to rank, dependency status, and duty location and our data set containing no information on the latter; and (3) the tax advantage cannot be easily estimated without information on total household income, home ownership, student status of dependents, and retirement contributions.

We are modeling officers and enlisted members separately, so including BAS would only increase intercept value in each respective model.

We believe the value of having information on duty location would greatly benefit

this research. Not only does duty location affect the pay entitlement; duty location may affect exposure to the civilian labor market. For example, a military member may have a higher probability of separating if they perceived a more robust labor market at their duty station if they were located at Bolling AFB (Washington, DC) as compared to Holloman AFB (Alamogordo, New Mexico). Since we do not have duty location, we eliminated BAH altogether from the value of compensation.

We defined the value of cash compensation in two parts, the benefit and cost. We first estimated the benefit as the discounted sum of cash flows of military compensation for the average military career, deferred retirement annuity for the average rank at retirement eligibility, and potential civilian earnings following retirement. We defined the average military career by constructing a theoretical enlisted and officer career from the average time-in-grade at the time of promotion for military members. Additionally, we retrieved average time-in-grade information from the Information Delivery System of the Office of Secretary of Defense. Furthermore, we estimated the annuity to be paid from the earliest retirement eligibility at the age of 42 until the expected year of death at 84 years old for officers, or from 40 to 80 years of age for enlisted members (OA, 2007: 27). We also assumed that individuals, whether they retired or separated from the military, would work until 62 years of age. To proxy for potential civilian wages, we retrieved the mean earnings of workers 18 years old and over by education attainment at the Bureau of Labor Statistics. The second portion of the value of cash compensation represented the cost of preferring military compensation. We assigned a negative value to the sum of discounted cash flows of potential civilian wages. We considered this value to be negative because when a military made the decision to remain in active duty

service, he or she did so at the cost of potential civilian wages earned today. We defined the value of cash compensation, therefore, as the sum of the compensation benefit and cost of continuing in active duty service in the Air Force.

We expected that the marginal effect of the value of cash compensation would increase the probability as the variable increased in value.

Intensity of Contingencies

Military contingencies geographically separate military members from their families, expose our services to increased operations tempo, and pose an increased risk for injury and death to our service members. Burrell (2007) developed this construct as a dummy variable for years in which the armed services were engaged in combat. Using this method assumed that all military contingencies have an equal effect on retention. A study indicated troops who served in Iraq are suffering from Post-Traumatic Stress Disorder (PTSD) and other problems on a scale not seen since the Vietnam War (Bernal, 2006:1). According to Walter Reed Medical Center Army Institute of Research, 19 to 21 percent of troops who returned from combat deployments meet criteria for PTSD, depression, or anxiety. In our research, we will explore the number of annual military casualties as a proxy for the intensity of military contingencies from year to year. The Office of the Secretary of Defense publishes annual casualty numbers at its website.

Healthcare Benefit

When military members and their dependents receive healthcare, they do so without incurring any personal financial cost. We considered this benefit difficult to quantify because the member makes no election of how much coverage he or she will receive. The member does not determine the dollars of coverage, the types of diseases or

injuries to be covered, or whether the coverage adjusts over time. Additionally, the medical benefit becomes more valuable as the member incurs more dependents. We defined the value of the medical benefit as the out-of-pocket expenses that the member avoided because they did not pay premiums or co-pays for private medical insurance. The Centers for Medicare and Medicaid Services provided total out-of-pocket expense data for policies of private industry workers. The data did not describe the cost of workers' coverage but the cost of the policy to the workers. We multiplied the out-of-pocket expenses avoided by the people in the military household to estimate the dollar value of military healthcare coverage. Lastly, we divided by the civilian wages a member would have earned had he or she separated to arrive at the percentage of income expected to fund healthcare costs in civilian employment.

For example, a single first lieutenant with a bachelor's degree in 2005 would value healthcare coverage in the Air Force as: $1,228 (Average out-of-pocket expenses) * 1 (number of people requiring coverage) / $54,689 (mean wages for bachelor's degree) or 2 percent. Likewise, an enlisted member with a family of four and some college completed would value healthcare coverage as: $1,228 * 4 / $33,496 or 15 percent. We used this method to estimate the percentage of expected civilian earnings that a member would pay in out-of-pocket expenses for healthcare coverage if they were to separate from active duty service in the Air Force. This estimate, although very simplistic, is comparable to previous estimates. Hosek *et al.* (2005:34) suggested that single military members should expect to pay about $1,000 per year in civilian coverage and over $3,000 (2005:35) for young families.

Gender

Gender plays a role in the decision to participate in the labor force. Galor and Weil found that "higher wages for women raise the cost of children relatively more than they raise household income, and lead to a reduction in the number of children that couples choose to have" (Galor and Weil, 1996: 375). For this reason, we expected that when women decide to leave active duty service, it would more likely happen early in their career before higher wages increased the opportunity cost of child bearing. Controlling for gender separated the marginal effect that military compensation or other factors may have on the probability of retaining men or women in active duty service from year n to year $n + 1$. We defined males as the base group.

Rank

Our use of rank introduced the concept that we expect military members to base their decision on what rank they hold. The military force structure promotes officers and enlisted members to encourage performance and to increase desire for more responsibility (OSD, 2005:9). "A promotion is not a reward for past service; it is an advancement to a higher grade based on future potential as demonstrated by past performance" (AFI 36-201, 2007:62). We expected as members are promoted, it would increase the probability of the individuals to remain in active duty service. We note that part of this effect can be explained with active duty service commitments. With a move-up-or-get-out policy in respect to promotions, we still find value in controlling for rank because reaching promotions give a member the opportunity to continue serving.

Air Force Specialty Code (AFSC)

We expected differences in the probability of a member to remain in active duty service when controlling for AFSC. We noted that availability of comparable civilian

jobs consistently ranked within the top three of thirty-eight influencing factors for separation from active duty service (Moon, 2004). Some AFSCs such as lawyers, program managers, and dental technicians may have a more robust job pool to choose from then those members that work as explosive ordinance technicians or boom operators on tanker aircraft. Additionally, some AFSCs may experience a higher OPSTEMPO that contributes adversely to retention rates. We separated our sampling frame in groups according to the first digit of the AFSC such that we control for the differences among those members in Operations (1), Maintenance/Logistics (2), Support (3), Medical/Dental (4), Legal/Chaplain (5), Acquisition/Finance (6), Special Investigations (7), Special Duty (8), and other AFSC identifier (9).

Methodology

Researchers often conduct regression analysis using continuous values to describe the dependent variable. Observing the dependent variable on this scale allows it to take on predicted values without restriction. The predicted value of the dependent variable may be expressed as an integer, as a decimal point, and even a negative number when regressed on the explanatory variables. While useful in other conditions, conventional Ordinary Least Squares (OLS) analysis does not reveal the interesting relationship we are concerned with in this thesis because its use constitutes a misspecification. We explain the misspecification in the subsection titled "Limited Probability Model."

We modeled the relationship of variables that influence the decision to either remain in active duty service (stay) or pursue employment elsewhere (go). We define this decision as the dependent variable "Continue." The explained variable does not take on continuous values; it is either "Stay" or "Go," or binary in nature. Therefore, we

model our independent variables to observe what factors are statistically significant in the individual decision analysis to continue on active duty service in the Air Force from year *n* to year *n + 1*.

Previous research modeled this relationship at the aggregate level. Burrell (2007) used continuation rates to proxy for retention. Continuation rates represent the percentage of Air personnel that continue in active duty service from one year to the next. Burrell's methodology observed how Air Force-level retention changes when factors such as military retirement, unemployment rates, and annual pay raises change. We model our data at the individual level. Researchers may use binary variables to describe a qualitative event; such as dummy variables in the explanatory variables to allow for an intercept change and/or a slope change amongst various groups. Instead, we use a binary variable to describe a qualitative event: will an individual stay in the Air Force ($y = 1$) or go ($y = 0$) with a given value of x_n?

Limited Probability Model

In the event where our explanatory variables describe a binary outcome, such as the decision to "stay or go" in this research, we may use the Limited Probability Model (LPM). In the regression model

$$y = \beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k + u,$$

we interpret the coefficients on the independent variables slightly different when y takes on two discrete outcomes than an in tradition OLS analysis. The dependent variable can either be zero or one in the LPM. We consider "success" to be when $y = 1$. As a result, the value by the regression estimates the probability of "success" given the values of the array x. We express this mathematically as

$$P(y = 1 \mid \mathbf{x}) = \beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k + u.$$

Therefore, we interpret the coefficients on β_j as the increase in probability of "success" in the qualitative event being observed. Some researchers may view the LPM as useful because the mechanics are the same as OLS; the model is linear in the parameters in β_j.

We highlight an inherent weakness with the LPM; potentially, the model response may include predicted values where $y > 1$ or $y < 0$. Despite the fact that individuals may claim to put forth 110% effort, a probability can only exist such that $0 < y < 1$. Additionally, the LPM restricts our estimations to linear interpretations. In this research, we will estimate the relationship that number of dependents may have on a military member's decision to stay or go. In a household with a military member, going from zero to one child may have more marginal influence on the probability of remaining in the service than going from three to four children. The LPM fails to account for this potential difference.

Probit Model for Binary Response

We discussed the inherent weaknesses found in the Linear Probability Model. Woolridge (2004: 583) states "the two most important disadvantages are that the fitted probabilities can be less than zero or greater than one and the partial effect of any explanatory variable is constant." The simplicity and weaknesses of LPM can be overcome through the use of the Probit, Logit, or Tobit Model for Binary Response. We used probit because the model assumes the error term is normally distributed and probit modeling is most commonly used in econometrics.

To address the first of the limitations we find in the LPM, we define our model such that

$$\Pr(y_i = 1 | x_i, \beta) = 1 - F(-x_i'\beta),$$

where we had a continuous, always-increasing function that will return a response probability that was equal to zero or one. As defined above, we estimated the effects of x_i on the response probability $P(y = 1 \mid \mathbf{x})$, or that a military member remained in the Air Force from year *n* to year *n* + 1 with the probit binary response model. We defined the opposite case, when a member separated or retired, as

$$\Pr(y_i = 0 | x_i, \beta) = F(-x_i'\beta).$$

We modeled the relationship that the independent variables had with the increase in probability of our response variable with the Eviews 6® statistical package software. We estimated the parameters on x_i, as a result of the specifications above, with the maximum likelihood function expressed as:

$$l(\beta) = \sum_{i=0}^{n} y_i \log(1 - F(-x_i'\beta)) + (1 - y_i)\log(F(-x_i'\beta)).$$

The latent variable model differed from OLS analysis here. In OLS, the coefficient on β_k estimated the ceteris paribus effect of x_k on the dependent variable, *y*. In a binary response model, the sign of the coefficient on the array on independent variables estimated the respective variable's influence on the probability of "success." In the latent variable model, we select a threshold such that when y_i* exceeds it,

$$y_i = \begin{cases} 1 & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \le 0. \end{cases}$$

We interpreted this expression as when the latent variable exceeded a certain value,

here given as value of zero, the model returned a value of one or a predicted "success." We are using the probit model for binary response such that

$$\Pr(y_i = 1 | x_i, \beta) = 1 - \Phi(-x_i'\beta) = \Phi(x_i'\beta)$$

where Φ is the cumulative distribution function of the standard normal distribution. (Eviews, 2007: 211).

Modeling our data in a probit model for binary response estimated the marginal effect that cash and noncash elements of military compensation had on the probability of successfully retain our Air Force men and women. We discuss our data and model analysis in the next section, Chapter 4.

IV. Data and Analysis

Our data contained a random sample of officers and enlisted members from the US Air Force in 2001. That cohort constituted 20 percent of the 2001 population and our data tracked the cohort until 2008. We modeled our data at three points available in our sampling frame: the stay-or-go decision from 2001 to 2002, 2004 to 2005, and 2007 to 2008. We emphasize that the data did not introduce new observations to the sampling frame in subsequent years. To the contrary, our data for year *n* contained only survivors from year *n* - 1. Therefore, we observed the cohort's years of service for each observation grow by one each year.

We placed a few restrictions on the data to constrain our analysis to observations that realistically faced a stay-or-go decision. Burrell (2007) made similar constraints that we adopted; Burrell eliminated individuals with the ranks of E1 through E4 and O1 through O2 in his analysis because the continuation rates were nearly 100 percent. We associated those high retention rates with active duty service commitments inherent when a member begins military service: four to six years for enlisted members and four to five years for officers. For this, we eliminated all observations with less than four years of service because enlisted members and officers, without a waiver to an active duty service commitment, cannot voluntarily separate from the Air Force.

Lastly, we eliminated all observations with greater than 18 years of service. We wanted to measure the influence of cash compensation on the decision to remain in active duty service up until retirement eligibility. Individuals nearing retirement eligibility may retire at varying points within a calendar year, and therefore we found much variance for military members with 19 years of service. The retention rates for 18 and 19 years both

exceed 99 percent; however, the retention rate following 20 years of service falls tremendously to 68 and 73 percent for officers and enlisted members, respectively. Restricting the upper bound for years of service at 18 eliminated the possibility of measuring observations that retire early on in their eligibility.

In order to ease interpretation of the model, we introduce a few terms. For a military member that continued service in a given year or separated, we defined the individuals as survivors or nonsurvivors, respectively. We also grouped members by years of service such that: Zone 1 = 4 – 7 years of service, Zone 2 = 8 – 11 years of service, Zone 3 = 12 – 15 years of service, and Zone 4 = 16 – 18 years of service.

In our discussion of results, we do not include the coefficients on **x** from our regression equation because the interpretation of the value differs greatly from traditional OLS. The coefficient in a probit model does not estimate the partial effect that an independent variable has on the probability of success. This characterizes one of the strengths of the probit model; the binary response model allows nonlinear effects of **x** on P(continue = 1). Instead, the coefficient is used to estimate the marginal effect when the independent variable changes from one specific value to another. For example, we could use the coefficients to estimate the probability of a military member continuing in service when the unemployment rate falls from 5.1 to 4.3 percent in 2004, or the increase in job opportunity that a male high school graduate observed when he acquired an associate degree. Since the coefficients are not linear in their parameters, we would expect the marginal effect to be smaller for that change as compared to a change in the unemployment rate from 5.1 to 2.7 percent, or when a male high school graduate acquired a baccalaureate degree in 2004.

In regards to policy analysis, we are more concerned with the direction of the marginal effect of statistically significant variables. As a result, we report the sign associated with significant inputs but do not discuss the magnitude of the effect. This method

Officer Personnel

Officer Results for 2001

We observed two significant variables in this model, the value of cash compensation and the unemployment rate. We found the value of cash compensation to be significant for officers in Zone 1 and the unemployment rate for officers in Zones 1, 2, and 3.

Table 2. Statistically Significant Variables for Officer Stay-or-Go Decision (2001)

Variable	Zone 1	Zone 2	Zone 3	Zone 4
Cash Compensation	+x*			
Medical Benefits				
Unemployment Rate	-x*	-x*	-x*	
R-Squared: 0.06	"x": significant at .05; "*": significant at .01 level			

The value of cash compensation's influence on the stay-or-go decision displayed the expected direction of influence, positive. The relationship implied that as the value of cash compensation inherent in military service increased above the value of earning civilian wages today, the probability of remaining in active duty service one additional year increased. We used annual retention rates to construct the table below to estimate the number of officers for every 100 that are lost during the specified range of years. Zone 1, which included officers with four to seven years of service, contained the largest attrition in manpower among officers. In efforts to retain the optimal mix of forces for

mission sustainment, the DoD should hope that compensation packages for Zone 1 favor retention of high quality officers since attrition is at its highest.

Table 3. 2001 Retention (Remaining For Every 100 Officers)

Range	YOS	Lost Officers	Remaining	% Lost
Zone 0	0 – 3	6	94	6.00%
Zone 1	4 – 7	33	61	35.11%
Zone 2	8 – 11	21	40	34.43%
Zone 3	12 – 15	9	31	22.50%
Zone 4	16 – 19	1	30	3.23%

Source: OSD Information Delivery System

Our findings provided that officers with four to seven years of service would rather defer earning civilian wages until after retirement eligibility. We did not observe statistically significant relationships between retention and the values of cash compensation for Zones 2 through 4.

Additionally, we found a statistically significant relationship between unemployment rates and the retention of officers in Zones 1 through 3; however, at first glance, the direction of the influence may seem counterintuitive. The model's results suggest the marginal effects of unemployment decreases the probability of those military officers becoming survivors; however we expect that military officers would prefer "safe" government employment when job opportunities lag in the private sector. When the economy is weak and unemployment rates increase, there are fewer jobs for those entering the civilian labor market. An investigation in the data reveals some items worthy of note.

We used unemployment rates based on two factors: gender and highest level of education attained. The unemployment rates in our data set vary among the following education levels: non-high school graduate, high school diploma, some college and/or associate degree, and baccalaureate degree and above. In the officer model for 2001, we

observe smaller than 1 percent of the sample to have less than a four-year degree in each of Zones 1, 2, and 3. The percentage for females with at least a baccalaureate degree in each respective zone is 21.3, 16.4, and 16.1 percent. Therefore, the marginal effect of the unemployment rate on officer retention controls more for job opportunity according to gender than levels of education. We expected that women separating from military service would do so earlier in a career rather than later since the opportunity cost associated with bearing children becomes prohibitively more expensive as wages increase. We strengthen that claim when we note that 36 percent of females with at least four-year degrees have between four to seven years of service as compared to 27 percent of males with the same level of education. While the proportions stay relatively stable for males in subsequent groups, we observed a progressive drop for females. This suggests that males and females perceived the stay-or-go decision differently as their careers progressed. Therefore, the negative marginal effect of unemployment rates measures the greater attrition for females with baccalaureate degrees and above when compared to males.

Officer Results for 2004

We observed two significant variables in this model, the value of cash compensation and the unemployment rate for officers with 4 to 7 years of active duty service and the value of the medical benefit for officers with 8 to 11 years of active duty service.

Table 4. Statistically Significant Variables for Officer Stay-or-Go Decision (2004)

Variable	Zone 1	Zone 2	Zone 3	Zone 4
Cash Compensation	+x*			
Medical Benefits		-x		
Unemployment				
R-Squared: 0.07	"x": significant at .05; "*": significant at .01 level			

Just as we noted in the 2001 model, the DoD benefits from the positive marginal effect of the value of military cash compensation on retention especially during periods where DoD suffered from its highest attrition rates. We see below that Zone 1 produced the largest drops in military officers again. In our 2004 model, we estimated that officers with four to seven years of service prefer to wait until after retirement eligibility to earn civilian wages because the value of cash compensation's marginal effect on the probability of continuing in the service is positive. We actually observed a stronger relationship on this variable and interaction than in the 2001 model; this estimation is confirmed when we see that retention in 2001 was 90.97 percent as compared to 91.5 percent for the same group in 2004.

Table 5. 2004 Retention (Remaining For Every 100 Officers)

Range	YOS	Lost Officers	Remaining	% Lost
Zone 0	0 – 3	6	94	6.00%
Zone 1	4 – 7	26	68	27.66%
Zone 2	8 – 11	14	54	20.59%
Zone 3	12 – 15	5	49	9.26%
Zone 4	16 – 19	2	47	4.08%

Source: OSD Information Delivery System

The 2004 model rendered unexpected results for the value of medical benefits. We anticipated that when expected out-of-pocket expenses increased, the military member would prefer to remain in active duty service to avoid out-of-pocket expenses inherent in private sector employment. We observed that the marginal effect of the

medical benefit decreased the probability of officers with eight to eleven years of service to remain in the Air Force. A non-parametric analysis of the data revealed some valuable explanation of the finding.

We divided the observations in Zone 2 into quartiles according to the value of the medical benefit variable such that the first quartile represented those officers with the highest values. The quartiles were not included in the regression model; the quartiles are examined to analyze what may possibly explain the results from our regression. Within the quartiles, we observed an imbalance in the proportion of females. We recorded these values in the table below along with the corresponding retention rates of each group. The value of the military medical benefit is the average out-of-pocket expenses a similar civilian employee paid. We defined "similar" as a civilian employee with the same number of dependents and highest level of education attained. Therefore, the female population of officers in Zone 2 looked like we expected them to: as the number of dependents grew, there were fewer females in the sampling frame.

Table 6. Analysis of Medical Benefit Influence on Officer Retention in Zone 2 (2004)

Quartiles	Observations	% Female	Female	Male
First	474	7.5	74.3	94.5
Second	474	11.4	94.6	94.5
Third	474	18.6	89.2	96.9
Fourth	474	24.2	94.2	96.4

We found an interesting detail in the retention comparison among genders for the first quartile, or when the value of medical benefits is greater: the retention rates differ by more than 20 percent. We believe this may explain the unexpected result of the marginal effect of the medical benefit on the probability of remaining in the service. This follows the claim that females separate from active duty service sooner as compared to males.

Additionally, we observed in the first two quartiles that every female that separated from the Air Force was married. Perhaps being married, and the possibility of having dual-income households, afforded these nonsurvivor females the ability to separate because medical needs of dependents were taken care of otherwise.

Officer Results for 2007

We observed three significant variables in the 2007 model: the value of cash compensation for officers with eight to eleven years of service, the value of the medical benefit for officers with eight to eleven years of service, and the unemployment rate for officers with four to seven years of service and officers with twelve to fifteen years.

Table 7. Statistically Significant Variables for Officer Stay-or-Go Decision (2007)

Variable	Zone 1	Zone 2	Zone 3	Zone 4
Cash Compensation		-x		
Medical Benefits		+x*		
Unemployment	-x*		+x*	
R-Squared: 0.17	"x": significant at .05; "*": significant at .01 level			

We found the value of cash compensation had a negative marginal effect on the probability of retention of officers with eight to eleven years of service. The Air Force employed a voluntary separation payment (VSP) incentive program then. Since the Air Force had an overage of 8,000 officers, it used VSP to incentivize those officers with six to exactly twelve years of service to voluntarily separate in rebalancing the forces. In 2007, the Air Force experienced an 82.7 percent retention rate for officers in Zone 2 as compared to 92 and 94.7 percent for the same zone in 2001 and 2004, respectively. At the time, active duty service commitments were waived for officers normally not eligible for separation due to promotions, permanent changes-of-station, and commitments associated with the use of education benefits.

VSP provided officers with payments that may have otherwise stayed in the Air Force. For example, we estimated the present value of future cash flows that a major with a baccalaureate degree and eleven years of active duty service as follows:

Present Value of Military Pay: $557,037

Present Value of Military Retirement Annuity Payments: $93,854

Present Value of Civilian Wages: - $532,114

We associated civilian wages with a negative sign because the military member accepts military compensation at the opportunity cost of civilian wages that could be earned today. In this example, the value of cash compensation was $118,777, but with a VSP payment of $147,913, the opportunity cost of not separating brought the value of cash compensation down to - $29,136. We remind that when the value of cash compensation carries a negative sign, the present value of future cash flows associated with civilian wages outweigh the compensation benefit inherent with serving in the military until retirement eligibility. Since VSP payments are paid in today's dollars without the effects of discounting, and calculated based on years of service and basic pay, an increase in military compensation actually increased the value of the VSP. As a result, the value of cash compensation had a negative marginal effect on the probability of retaining Air Force officers with eight to eleven years of active duty service.

We observed statistical significance on the value of medical benefit for military officers with eight to eleven years of service. We highlighted the force shaping dynamic on this group in 2007. With VSP payments, enterprising military officers took advantage of incentives to separate from the Air Force, relatively safe employment, for riskier prospects in the private sector. Military members may have had a higher propensity to

separate from active duty service when the members did not have dependents. We divided the sampling frame into quartiles according to ascending values of perceived medical benefit.

Table 8. Analysis of Medical Benefit Influence on Officer Retention (2007)

Zone 2 (Officers with 4 - 7 YOS)			Average # of Dependents	
Range	Observations	Retention %	Non-survivors	Survivors
Quartile 1	450	79.11%	0.26	0.38
Quartile 2	450	81.33%	1.23	1.37
Quartile 3	451	84.70%	2.45	2.65
Quartile 4	450	85.56%	3.81	3.85

Source: Defense Manpower Data Center

We saw that as the average number of dependents grew from one quartile to the next, the aggregate retention rates did as well. Additionally, within the quartiles, we observed that the average number of dependents increased from non-survivors to survivors. Therefore, those military members that remained in the service with four to seven years may have done so because VSP did not provide the financial stability required by members with families. Air Force officers with families did not pursue risky employment with the same frequency as those members with fewer dependents.

In 2001, we had an unexpected result when our model rendered a negative marginal effect of the unemployment rate on the probability of remaining on active duty service. We realized a negative effect again for the unemployment rate in 2007 on the retention of military officers with four to seven years. Smaller than one percent of officers had less than a four-year degree in Zone 1, but there were 20.3 percent of females that had baccalaureate degrees or higher. Our regression, similar to the officer model for 2001, may have been influenced more by the difference in retention among males and females. While exploring possible differences in attrition behavior between the two genders, we observed that the Air Force realized retention rates of 62.6 and 77.2 percent

for females and males, respectively, for officers in 2004. Therefore, the unemployment rate measured the greater propensity of similarly educated females as compared to males to leave military service early on in their careers.

The unemployment rate had a significant marginal effect on the probability of retaining military officers with twelve to fifteen years of service, as well; however, for this zone the relationship was a positive one. Overall, we saw high retention rates for this subgroup, 97.26 percent, and expected such because of the approach towards retirement eligibility and the stream of cash flows expected following retirement. Civilian workers with less than a four-year degree suffered worse unemployment rates than workers that had completed a bachelor degree program. Therefore, those military officers with less than a four-year degree were exposed to more risk (higher unemployment rate) and less return (lower mean wages) than those officers that separated with at least a baccalaureate degree. Females with four-year degrees faced a higher unemployment rate than their male counterparts. We noted that females tend to leave the labor market early so we expected retention rates of females to improve more quickly than males. In our sampling frame, the retention rates of female officers confirmed this expectation: 97.6 percent for females and 97.2 percent for males with at least four-year degrees.

Enlisted Personnel

Enlisted Results for 2001

We observed three statistically significant variables in the 2001 model, the value of cash compensation for enlisted members with eight to eleven and twelve to fifteen years of active duty service; the value of medical benefits for members with four to seven years of

service; and the unemployment rate for enlisted personnel with four to seven and eight to eleven years of service.

Table 9. Statistically Significant Variables for Enlisted Stay-or-Go Decision (2001)

Variable	Zone 1	Zone 2	Zone 3	Zone 4
Cash Compensation		+x*	+x*	
Medical Benefits	+x*			
Unemployment	-x	-x		
R-Squared: 0.06	"x": significant at .05; "*": significant at .01 level			

The table below displays the retention rates according to zone, a range of four years, leading up to retirement eligibility. We observed far more aggressive attrition rates for enlisted members as compared to officers in the earlier stages of their respective military careers. Only 80 percent of enlisted members remained in the service after the third year; 94 percent of officers were still in uniform after the same length of time. This may be a result of greater opportunities that exist for officers later in their military careers than enlisted personnel and the force structure design for enlisted personnel.

Table 10. 2001 Retention (Remaining For Every 100 Enlisted)

Range	YOS	Lost Enlisted	Remaining	% Lost
Zone 0	0 – 3	20	80	20.00%
Zone 1	4 – 7	43	37	53.75%
Zone 2	8 – 11	13	24	35.14%
Zone 3	12 – 15	4	20	16.67%
Zone 4	16 – 19	0	20	0.00%

Source: OSD Information Delivery System

The optimal mix of forces by rank and skill is outside of the scope of this research, but we do find it reasonable to believe that the Air Force desired a high number of enlisted recruits for at least two reasons: (1) to fill entry-level positions that did not require much experience for proficiency and (2) to have enough enlisted members to fill non-commissioned officer positions following a series of promotions later in their respective careers. The purpose of military compensation is to maintain the optimal mix

of forces to carry out mission requirements according to national security objectives. We expect the DoD would define compensation values to retain better-qualified enlisted members to continue in service and, as a result, less qualified enlisted members would self-identify for separation if they did not feel that they could compete for advanced promotions.

These statements support the findings from our model of 2001 enlisted personnel. We found the value of cash compensation had a positive marginal effect on the probability of enlisted personnel with eight to eleven and twelve to fifteen years of service. The DoD has long-term incentives such as deferred retirement and medical benefits to provide motivation to high quality recruits to remain in service that will be competitive for advanced promotion and job placement later in their career. For every 100 military members that enlisted in a given year, according to 2001 retention rates, 37 would remain at the end of the 7^{th} active duty service year; over the course of the next 13 years, the Air Force expected that better than 50 percent of those still in uniform would be retained until retirement eligibility. We conclude that the positive marginal effect on the probability of retention on the personnel with seven to fifteen years of service measured the retention of personnel that intended to become career military men and women, and as a result, fill senior enlisted non-commissioned officer ranks.

We observed a positive marginal effect of medical benefits on the probability of retaining enlisted personnel with four to seven years of service. We did not find significance on the value of cash compensation for the same group, so enlisted members in this category, when preferring military service to civilian employment, did so because of this element of non-cash compensation. Members desired non-cash benefits above the

defined compensation received as either pay or deferred annuity payments when the number of dependents increased. For example, SSgt X amd SSgt Y had the same number years of service and education level, so both could expect similar civilian wages should they separate. If SSgt X was single with zero dependents and SSgt Y maintained a family of four, SSgt Y needed to earn higher civilian dollars—after paying for medical insurance premiums and co-pays for his dependents—to maintain the same purchasing power as SSgt X.

We found the unemployment rate's marginal effect on the probability of retaining enlisted members with four to seven and eight to eleven years of service to be negative. The relationship infers that when the unemployment rate climbed, retention went down. We observed something similar for 2001 in the officer model, but were able to attribute much of this effect to gender rather than education levels. In Zone 1, enlisted service members were either in their first or second enlistment term and the overall retention rate was 98.2 percent. We attribute the 100 percent retention rate among those members with at four-year degree to active duty service commitments associated with taking advantage of tuition assistance or other education benefits. Additionally, the enlisted members that pursued four-year degrees may have shared similar characteristics with the enlisted members that served in the military until or beyond retirement eligibility. The second claim helped explain why we also observed a negative relationship with the unemployment variable and enlisted members with eight to eleven years. Enlisted personnel increased the probability of serving to retirement eligibility when they emerged from their eleventh year of service. Therefore, we anticipate greater retention among

those members with four-year degrees, especially if they were accepted and completed a commissioning program to serve as an active duty military officer.

Enlisted Results for 2004

We observed two statistically significant variables in the 2004 model, the value of cash compensation for enlisted members with four to seven, eight to eleven, and sixteen to eighteen active duty service years; and the value of medical benefit for members with four to seven years of service.

Table 11. Statistically Significant Variables for Enlisted Stay-or-Go Decision (2004)

Variable	Zone 1	Zone 2	Zone 3	Zone 4
Cash Compensation	+x	+x*		+x*
Medical Benefits	+x*			-x*
Unemployment				
R-Squared: 0.08	"x": significant at .05; "*": significant at .01 level			

Our model returned a positive marginal effect of the value of cash compensation on the probability of retention for enlisted personnel with four to seven years. We suggest that a response to the recession following the 9/11 tragedy may have contributed to enlisted members making their continuation decision did so because members perceived the present value of cash flows inherent in military service greater than earning civilian wages today. This may explain why we observed an improvement in attrition in Zone 1 from 53.8 percent in 2001 to 39.5 percent in 2004. Following the recession, junior enlisted Airmen preferred “safe” government employment to riskier prospects despite the fact that they could have earned higher wages over the course of their lives even if they didn’t pursue further education.

Table 12. 2004 Retention (Remaining For Every 100 Enlisted)

Range	YOS	Lost Enlisted	Remaining	% Lost
Zone 0	0 – 3	24	76	24.00%
Zone 1	4 – 7	30	46	39.47%
Zone 2	8 – 11	12	34	26.09%
Zone 3	12 – 15	3	31	8.82%
Zone 4	16 – 19	1	30	3.23%

Source: OSD Information Delivery System

We suggested after seeing the slowdown in attrition following Zone 2 that enlisted personnel tend to become career military service members following their eleventh year in the Air Force. We saw that for every 100 enlisted members beginning service in the same year, according to 2004 retention rates, 34 continued on after eleven years; however, only four would separate before retirement eligibility over the course of the next nine years. The marginal effect of the value of cash compensation increased the probability of bringing members to the critical eleven-year point that gave the Air Force its senior enlisted corps.

Additionally, deployments in support of the Global War on Terrorism provided monetary incentive through entitlements such as Combat Zone Tax Exclusion, Family Separation Allowance, and Hazardous Duty Pay. These incentives may have further increased the value of military compensation over civilian earnings.

The value of cash compensation had a positive marginal effect on the retention of enlisted members in Zone 4, or members with sixteen and eighteen years of service and approaching retirement eligibility. We observed that 99.4 percent of those observations perceived more value in serving and subsequently retiring from the military over separating and earning civilian wages today. We highlight that attrition for enlisted members in Zones 3 and 4 were 16.7 percent and smaller than one percent, respectively, to support the tendency of enlisted Airmen choosing career military service if they

completed eleven years of service. We expected the high retention rates during Zone 4; we see from our analysis that the value of cash compensation, largely because of the military retirement annuity, was the dominating factor above non-cash compensation and the economy for this high retention rate.

We observed a negative marginal effect that described the influence of the value of medical benefits on the probability of retaining enlisted personnel with four to seven years of service. To investigate the result, we analyzed how the continuation rates of females within Zone 1 compared when dividing the group into quartiles according to ascending value of medical benefit. We noted before that we expect females to separate or retire before the opportunity cost of child bearing became increasingly expensive. We saw here that as the value of medical benefit increased, females separated at a faster rate. The retention for the quartiles was 94.4, 93.2, 89.0, and 84.2 percent for females. We observed a very different effect for males; the respective retention rates for the quartiles were 89.7, 89.2, 96.4, and 94.4 percent. Therefore, the negative marginal effect of the value of medical benefit on the probability of retaining personnel with four to seven years may have captured the tendency of females to separate from service for child bearing. We noticed that as the number of dependents grew for females, they were more likely to separate and perhaps stay at home with the children.

Enlisted Results for 2007

We observed three statistically significant variables in the 2007 model, the value of cash compensation for enlisted members of all years of service, the value of medical benefit for members with four to seven years of service and eight to eleven years, and the

unemployment rate for enlisted personnel with four to seven years of service and eight to eleven years.

Table 13. Statistically Significant Variables for Enlisted Stay-or-Go Decision (2007)

Variable	Zone 1	Zone 2	Zone 3	Zone 4
Cash Compensation	+x*	+x*	+x*	+x*
Medical Benefits	+x	+x*		
Unemployment	-x*	-x*		
R-Squared: 0.08	"x": significant at .05; "*": significant at .01 level			

We saw from the table below that enlisted personnel separated at a faster rate in early years as compared to officers so the value of cash compensation's played a larger role in retention for enlisted members.

Table 14. 2007 Retention (Remaining For Every 100 Enlisted)

Range	YOS	Lost Enlisted	Remaining	% Lost
Zone 0	0 – 3	21	79	21.00%
Zone 1	4 – 7	44	35	55.70%
Zone 2	8 – 11	12	23	34.29%
Zone 3	12 – 15	3	20	13.04%
Zone 4	16 – 19	1	19	5.00%

Source: OSD Information Delivery System

Our model provided that the value of cash compensation inherent in remaining in the Air Force to retirement eligibility had a positive marginal effect on the probability of all enlisted members continuing in service for one more year. The DoD should appreciate the finding that when the value of remaining in the military—the summation of cash flows found in military compensation, deferred retirement annuity payments, and the civilian earnings expected following retirement until the age of 62—increased against the value of civilians earned today until retirement, the probability of retention of enlisted personnel with four to eighteen years of service increased. The favorable results may have been linked to the added benefit of contingency entitlements for those members that

deployed in support of the Global War on Terror since the largest benefit, the income tax exemption, was proportionally linked to the value of basic pay.

Our modeled estimated a positive marginal effect of the value of medical benefits on the probability of remaining in the service for enlisted members with four to seven years of service and eight to eleven years. We found a noteworthy item regarding the value of medical benefit, or the percentage of expected civilian earnings that would go to out-of-pocket medical expenses outside of private medical insurance. Within the Zone 1 subgroup, 78.5 enlisted members had only high school diplomas and 21.5 had at least an associate degree. The respective rates for those members were 88.8 percent and 85.2 percent. We found of the enlisted members in Zone 2, 69.3 percent had less than an associate degree, 25.5 percent had an associate degree, and 5.2 percent had at least a four-year degree. The retention rates for those groups were 92.3, 90.4, and 89.2 percent, respectively. We concluded that enlisted members with less than an associate degree and not enough valuable experience did not anticipate that they would find high enough wages to cover the medical needs of themselves and their dependents and therefore had higher retention rates.

We observed a negative marginal effect of unemployment rates on the probability of retention of enlisted members with four to seven and eight to eleven years of service. The tables below contain retention rates for the different groups by their respective unemployment rates according to gender and highest level of education attained.

Table 15. Analysis of Unemployment Influence on Enlisted Retention in Zone 1 (2007)

Education	Unemployment	Observations	Retention
4 Year+ (M)	1.90%	39	94.90%
4 Year+ (F)	2.10%	20	85.00%
Some College (M)	3.40%	293	84.00%
Some College (F)	3.70%	196	84.70%
High School (F)	4.30%	447	86.10%
High School (M)	4.40%	1553	89.60%

Table 16. Analysis of Unemployment Influence on Enlisted Retention in Zone 2 (2007)

Education	Unemployment	Observations	Retention
4 Year+ (M)	1.90%	255	91.00%
4 Year+ (F)	2.10%	114	85.10%
Some College (M)	3.40%	1251	89.10%
Some College (F)	3.70%	548	88.10%
High School (F)	4.30%	944	90.30%
High School (M)	4.40%	3948	91.70%
No High School (M)	8.20%	1	100.00%

We believe the active duty service commitments that enlisted members incur when using educational benefits may influence retention by removing the ability to make a decision. This would explain why retention rates are higher for members with four-year degrees than those with only some college or associate degrees despite the fact that those with four-year degrees would expect higher civilian wages. The members with less than a four-year degree but some college may have stopped attending school altogether or temporarily to attend college as a civilian without incurring active service commitments.

V. Conclusion

This chapter will address the findings, the validity of those findings, and policy implications. Lastly, we offer suggestions to expand on this research to improve the robustness of the model.

Summary and Implications

After reviewing government publications, peer-review journals, independent research, theses, and dissertations we saw potential for addition to the body of knowledge of military retention. Previous work focused on Air Force personnel as a whole and, in turn, virtually treated all individuals as the average military member. Service in the armed forces is an emotional decision. Members join for a variety of personal reasons and the reasons surrounding their retention are just as personal. Air Force men and women respond to job challenges, assignments, contingencies, separation from family, and other decision criteria differently. Military compensation, whether cash or non-cash, serves as an enabler of continuation but is not the sole instrument in retention.

So how do military members respond to this enabler of continuation when modeled at the individual level? Our findings suggest that officers with four to seven years of service respond positively to compensation inherent in a military career over a civilian one. The Air Force suffers the largest rate of attrition of officers during the four- to seven-year marks. The DoD should hope that during a vulnerable period of retention, the remaining members are the best mix of forces to field senior positions. Enlisted personnel respond positively to military compensation as well. We found that enlisted members tend to separate more aggressively as compared to officers; however, as they emerge from the seven-year mark, the probability of them continuing to serve to

retirement eligibility greatly improves. For these groups of officers and enlisted members, the value of cash compensation has a statistically significant impact on their decision to continue. In order to retain the caliber of military members needed to field mid-level and subsequently senior leadership positions, military compensation must be adequate enough to retain high-quality members to effectively sustain operations.

We also observed two interesting details regarding gender and education levels. We found the quit behavior between males and females do not follow the same pattern. When a female serves in active duty, she is more likely to be have less than eight years of service because females tend to separate sooner in their careers rather than later. Additionally, we observed statistically significant differences among enlisted members with varying levels of education. Enlisted personnel with four-year degrees tend to remain in the Air Force. The military member that pursues education to better their standing may share similar characteristics with those members that serve in the Air Force to retirement eligibility.

Suggestions For Further Research

Our research would have greatly benefited from the use of time series analysis. We planned to estimate the probability of a military member's decision to continue in military service over time with a binary response probit model over time with our cohort; however, time did not permit such an ambitious endeavor. Although our research revealed interesting points, low R-Squared values for our models suggest that the methodology did not suit the variance in our dependent variable with consistent accuracy. Our data contained a key variable for each observation and tracked the survivors across time from 2001 to 2008. Time series analysis could estimate how the influence of cash

and non-cash compensation on the individual affected the probability of continuation in service. Instead, in the interest of time, we were required to estimate with the much less robust method of cross-sectional analysis.

Cross-sectional analysis greatly changed our methodology. Deferring to this methodology changed the interpretation of some of our variables, led to the omission of variables, and prevented the ability to control for groups that we found interest in estimating differences for.

We had a series of dummy variables such as gender, AFSC, rank, and deployment status. When estimating across a single year, we encountered the problem associated with perfect predictions. For example, we may have experienced variance in the dependent variable for female majors that served in the medical support group of AFSCs; however, when we included the dummy variable for deployment, we could have observed that 100 percent of female medical officers with the rank of major and deployed continued in service. When an event such as this occurs, we cannot control for differences among groups even when we have a large sample size because no difference may exist.

Our dataset included information on the deployment status of each military member in a particular year. In time-series analysis, we could have measured the impact of multiple deployments on a member's decision to continue in service. We anticipated the grueling challenges of increased operations tempo and chronic separation from family would better explain the variance found in the decision to stay-or-go than whether the member was deployed in a given year.

When a member deployed for four, six, or twelve months it was very likely he or she would continue in service the following year because deployments could potentially cross calendar years. Additionally, military members faced active duty service commitments and may not have had the ability to separate in the time between redeploying and the end of the calendar year. Also of note, the Air Force provided monetary incentive in the form of additional entitlements to those members that deployed in support of contingency operations.

A single deployment and the extra income associated with it may not have dissuaded a member from continuing in service, but subsequent deployments could have diminished the value of the monetary incentives. Without the benefit of a lagged dependent variable or the ability to quantify for multiple deployments, the deployment status did not explain the variance it would have with the benefit of time series analysis. Ultimately, we did not find relevance for this variable in cross-sectional analysis and eliminated it from our analysis.

We noted unexpected results from the unemployment variable for some groups at first glance; however, further analysis provided better explanation of what our model had estimated. In cross-sectional analysis, the unemployment variable measured the marginal effect of varying civilian employment opportunities—controlling for gender and highest level of education attained—on the probability of retention of military personnel. In time series analysis, measuring how the relationship between potential alternative employment and retention differed from one year to the next, would increase the explanatory power of our model. Without time series analysis, we could not account for the changes in

unemployment and the economy across time and how military members responded to those changes.

Most importantly, as we noted earlier, military members incurred lengthy service obligations after permanent changes-of-station, promotions, and taking advantage of education benefits. For example, a military member that preferred not to deploy following the Iraqi invasion in 2003, may have had to wait until 2005 to do so. Our cross-sectional analysis could not account for this lagged response. This may explain why we observed the highest R^2 value in our officer model for 2007; Air Force officers were granted waivers to active duty service commitments that immediately allowed them to voluntarily separate. Largely, military members did not act on immediate response to variables that affect the decision to stay or go because active duty service commitments may differ from zero days to five years. Without lagged variables, we cannot optimize at what point inputs to the model change the binary response from continue in service to separate for civilian earnings.

Conclusion

The DoD designs compensation to be adequate and fair to support manpower policies without crowding-out operations, readiness, recapitalization and modernization of weapon systems. Additionally, compensation must motivate personnel performance while being responsive to private sector wages and effective during times of peace and war. Senior decision makers should use our work to support manpower policies that are put in place. While our research did not explore whether the remaining forces that fill Air Force ranks are the best mix of personnel, we can conclude cash compensation served as an effective retention instrument for those members that remained.

Appendix A: 2001 Officer Model Results

Dependent Variable: CONTINUE
Method: ML - Binary Probit (Quadratic hill climbing)
Date: 04/20/08 Time: 23:09
Sample (adjusted): 1 7176
Included observations: 7176 after adjustments
Convergence achieved after 13 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	2.538729	0.293852	8.639497	0
VCASH*ZONE1	1.69E-06	4.52E-07	3.731807	0.0002
VCASH*ZONE2	-9.88E-07	5.61E-07	-1.762157	0.078
VCASH*ZONE3	-4.38E-07	8.61E-07	-0.508942	0.6108
VCASH*ZONE4	4.86E-07	2.44E-06	0.199338	0.842
VMB*ZONE1	3.369787	1.884855	1.787823	0.0738
VMB*ZONE2	1.566568	1.77226	0.883938	0.3767
VMB*ZONE3	1.85337	2.242601	0.826438	0.4086
VMB*ZONE4	3.400274	5.11684	0.664526	0.5064
UR*ZONE1	-54.92291	13.66228	-4.020039	0.0001
UR*ZONE2	-62.52325	15.10927	-4.138072	0
UR*ZONE3	-45.77213	15.40019	-2.972179	0.003
UR*ZONE4	-20.38396	30.65498	-0.664948	0.5061

McFadden R-squared	0.055949	Mean dependent var	0.939521
S.D. dependent var	0.238389	S.E. of regression	0.235982
Akaike info criterion	0.434648	Sum squared resid	398.8901
Schwarz criterion	0.447109	Log likelihood	-1546.515
Hannan-Quinn criter.	0.438936	Restr. log likelihood	-1638.17
LR statistic	183.3084	Avg. log likelihood	-0.215512
Prob(LR statistic)	0		
Obs with Dep=0	434	Total obs	7176
Obs with Dep=1	6742		

Appendix B: 2004 Officer Model Results

Dependent Variable: CONTINUE
Method: ML - Binary Probit (Quadratic hill climbing)
Date: 04/20/08 Time: 23:04
Sample: 1 7240
Included observations: 7240
Convergence achieved after 13 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1.811846	0.444334	4.077666	0
VCASH*ZONE1	1.34E-06	3.87E-07	3.456287	0.0005
VCASH*ZONE2	2.77E-07	5.59E-07	0.496032	0.6199
VCASH*ZONE3	-6.14E-07	9.06E-07	-0.677525	0.4981
VCASH*ZONE4	-3.21E-06	3.03E-06	-1.062194	0.2881
VMB*ZONE1	1.716669	1.587014	1.081697	0.2794
VMB*ZONE2	-3.656509	1.62992	-2.243367	0.0249
VMB*ZONE3	-2.677713	2.207703	-1.212896	0.2252
VMB*ZONE4	1.622781	5.65046	0.287194	0.774
UR*ZONE1	-14.88141	15.9645	-0.932157	0.3513
UR*ZONE2	1.049714	16.79955	0.062485	0.9502
UR*ZONE3	11.5699	17.48456	0.661721	0.5082
UR*ZONE4	56.87203	34.32418	1.656909	0.0975

McFadden R-squared	0.066791	Mean dependent var	0.951519
S.D. dependent var	0.214794	S.E. of regression	0.212494
Akaike info criterion	0.365708	Sum squared resid	326.3256
Schwarz criterion	0.378075	Log likelihood	-1310.864
Hannan-Quinn criter.	0.369962	Restr. log likelihood	-1404.684
LR statistic	187.6406	Avg. log likelihood	-0.181059
Prob(LR statistic)	0		

Obs with Dep=0	351	Total obs	7240
Obs with Dep=1	6889		

Appendix C: 2007 Officer Model Results

Dependent Variable: CONTINUE
Method: ML - Binary Probit (Quadratic hill climbing)
Date: 04/20/08 Time: 22:58
Sample: 1 5522
Included observations: 5522
Convergence achieved after 13 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1.259863	0.317774	3.964647	0.0001
VCASH*ZONE1	-5.08E-07	5.68E-07	-0.894623	0.371
VCASH*ZONE2	-1.07E-06	4.17E-07	-2.566638	0.0103
VCASH*ZONE3	6.78E-07	8.95E-07	0.757936	0.4485
VCASH*ZONE4	8.91E-07	2.46E-06	0.361728	0.7176
VMB*ZONE1	3.929971	2.145962	1.831333	0.0671
VMB*ZONE2	4.060231	1.211164	3.352338	0.0008
VMB*ZONE3	-2.072072	2.149751	-0.963866	0.3351
VMB*ZONE4	-3.165035	4.108019	-0.770453	0.441
UR*ZONE1	-43.00063	16.2532	-2.645671	0.0082
UR*ZONE2	-28.82819	15.95184	-1.807201	0.0707
UR*ZONE3	37.45274	18.15676	2.062743	0.0391
UR*ZONE4	65.42751	38.41602	1.703131	0.0885

McFadden R-squared	0.173752	Mean dependent var	0.905107
S.D. dependent var	0.293094	S.E. of regression	0.277627
Akaike info criterion	0.523121	Sum squared resid	424.6149
Schwarz criterion	0.538698	Log likelihood	-1431.338
Hannan-Quinn criter.	0.528553	Restr. log likelihood	-1732.334
LR statistic	601.992	Avg. log likelihood	-0.259206
Prob(LR statistic)	0		
Obs with Dep=0	524	Total obs	5522
Obs with Dep=1	4998		

Appendix D: 2001 Enlisted Model Results

Dependent Variable: CONTINUE
Method: ML - Binary Probit (Quadratic hill climbing)
Date: 04/05/08 Time: 08:38
Sample: 1 22768
Included observations: 22768
Convergence achieved after 12 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1.852682	0.15401	12.02964	0
VCASH*ZONE1	-1.39E-07	9.48E-07	-0.146218	0.8837
VCASH*ZONE2	4.23E-06	7.92E-07	5.337816	0
VCASH*ZONE3	3.21E-06	1.05E-06	3.069622	0.0021
VCASH*ZONE4	2.85E-06	1.49E-06	1.916966	0.0552
VMB*ZONE1	2.368503	0.838682	2.824077	0.0047
VMB*ZONE2	0.887352	0.653741	1.357345	0.1747
VMB*ZONE3	0.844218	0.838969	1.006256	0.3143
VMB*ZONE4	0.639491	1.349963	0.47371	0.6357
UR*ZONE1	-7.797467	3.734851	-2.087759	0.0368
UR*ZONE2	-8.643032	4.100513	-2.107793	0.035
UR*ZONE3	-4.320598	5.463046	-0.790877	0.429
UR*ZONE4	0.321137	8.553824	0.037543	0.9701

McFadden R-squared	0.064877	Mean dependent var	0.972461
S.D. dependent var	0.16365	S.E. of regression	0.162426
Akaike info criterion	0.236941	Sum squared resid	600.3236
Schwarz criterion	0.241528	Log likelihood	-2684.341
Hannan-Quinn criter.	0.238433	Restr. log likelihood	-2870.574
LR statistic	372.4658	Avg. log likelihood	-0.1179
Prob(LR statistic)	0		
Obs with Dep=0	627	Total obs	22768
Obs with Dep=1	22141		

Appendix E: 2004 Enlisted Model Results

Dependent Variable: CONTINUE
Method: ML - Binary Probit (Quadratic hill climbing)
Date: 04/05/08 Time: 08:46
Sample: 1 23407
Included observations: 23407
Convergence achieved after 12 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1.464282	0.171634	8.531428	0
VCASH*ZONE1	1.59E-06	6.56E-07	2.42066	0.0155
VCASH*ZONE2	2.60E-06	7.52E-07	3.460205	0.0005
VCASH*ZONE3	1.52E-06	1.06E-06	1.437979	0.1504
VCASH*ZONE4	4.81E-06	1.70E-06	2.822247	0.0048
VMB*ZONE1	1.385772	0.440456	3.14622	0.0017
VMB*ZONE2	-0.388268	0.518258	-0.74918	0.4537
VMB*ZONE3	0.901973	0.842658	1.070391	0.2844
VMB*ZONE4	-3.597183	1.2549	-2.86651	0.0042
UR*ZONE1	-3.327205	3.474156	-0.957702	0.3382
UR*ZONE2	2.325641	4.107259	0.566227	0.5712
UR*ZONE3	7.165595	5.681269	1.261266	0.2072
UR*ZONE4	8.240057	10.71595	0.768952	0.4419

McFadden R-squared	0.076855	Mean dependent var	0.955526
S.D. dependent var	0.20615	S.E. of regression	0.203745
Akaike info criterion	0.33697	Sum squared resid	971.1282
Schwarz criterion	0.341447	Log likelihood	-3930.733
Hannan-Quinn criter.	0.338424	Restr. log likelihood	-4257.981
LR statistic	654.4948	Avg. log likelihood	-0.16793
Prob(LR statistic)	0		
Obs with Dep=0	1041	Total obs	23407
Obs with Dep=1	22366		

Appendix F: 2007 Enlisted Model Results

Dependent Variable: CONTINUE
Method: ML - Binary Probit (Quadratic hill climbing)
Date: 04/20/08 Time: 13:00
Sample: 1 17667
Included observations: 17667
Convergence achieved after 12 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1.748679	0.127066	13.76195	0
VCASH*ZONE1	3.89E-06	9.58E-07	4.065983	0
VCASH*ZONE2	3.26E-06	5.35E-07	6.083885	0
VCASH*ZONE3	2.31E-06	8.49E-07	2.723307	0.0065
VCASH*ZONE4	3.09E-06	1.20E-06	2.581175	0.0098
VMB*ZONE1	1.600923	0.631422	2.535423	0.0112
VMB*ZONE2	1.119744	0.400846	2.793454	0.0052
VMB*ZONE3	0.480192	0.691202	0.69472	0.4872
VMB*ZONE4	-0.218497	1.138853	-0.191857	0.8479
UR*ZONE1	-17.33753	3.408329	-5.086812	0
UR*ZONE2	-15.08669	3.517878	-4.288576	0
UR*ZONE3	-4.578489	5.189391	-0.882279	0.3776
UR*ZONE4	-8.224954	9.201136	-0.893906	0.3714

McFadden R-squared	0.075733	Mean dependent var	0.94085
S.D. dependent var	0.235912	S.E. of regression	0.232321
Akaike info criterion	0.416693	Sum squared resid	952.8412
Schwarz criterion	0.422417	Log likelihood	-3667.856
Hannan-Quinn criter.	0.418577	Restr. log likelihood	-3968.393
LR statistic	601.0752	Avg. log likelihood	-0.207611
Prob(LR statistic)	0		
Obs with Dep=0	1045	Total obs	17667
Obs with Dep=1	16622		

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14. ABSTRACT
In July 2001, Lieutenant General Donald L. Peterson, Deputy Chief of Staff, Personnel, United States Air Force, testified before Congress that adverse retention rates were senior leadership's number one concern. Military compensation sustains "defense manpower policies that in turn support the nation's defense strategy." Defense spending must be allocated efficiently to maintain the optimal mix of forces and weapon systems to respond to national security objectives. The President requested $149.9 billion for military pay and healthcare for Fiscal Year 2009, or 29 percent of the total proposed defense budget. When military compensation constitutes nearly one-third of department expenses, its impact on retention of personnel must meet targets. This thesis estimates the value of military compensation's effect on the probability of retaining Air Force personnel in a cross-sectional analysis. The findings suggest that compensation packages are effective at retaining military members at critical points in their career to develop senior officer and enlisted leaders. Prior research estimated at the aggregate level, but we modeled our data for individual observations to estimate how members prefer to delay civilian earnings until after retirement eligibility. We found that our findings, while interesting, would improve if estimated through a binary probit model in time-series analysis.

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